

*M.Sc. Zoology Final Practical File (VMOU) Session July-2023 (Camp Sep.-Dec. 2024)*

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VISIT & SUPPORT-

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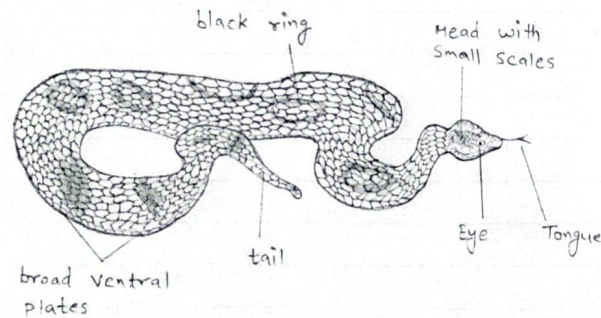
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### **Genetics**

75. Multiple allele problems



Phylum - Chordata  
Class - Reptilia  
Order - Squamata  
Genus - Vipera



Vipera (Pitless Viper)

*for*

## Vipera (Pitless Viper)

DATE
PAGE

### Classification:-

Phylum - Chordata (Dorsal tubular nerve cord, notochord and gill slits present)

Class - Reptilia (Skin dry, covered by horny scales or bony plates)

Order - Squamata (Vertebrae procoelous, teeth acrodont or pleurodont)

Genus - Vipera

Habit and Habitat:- Vipera are commonly found from Europe, Asia, Sri Lanka, Burma and India. It is found in rocky and bushy regions. It feeds on mice, rats, lizards and birds.

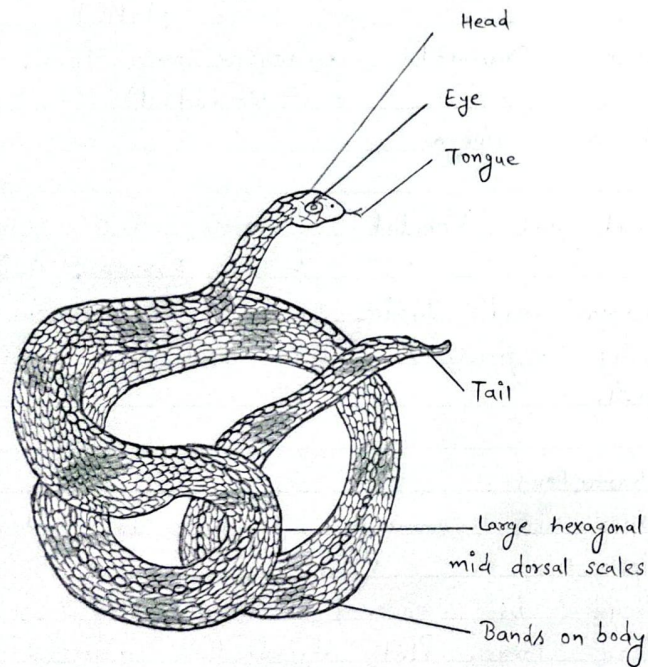
### Characters:-

1. Viper is commonly known as mobia, it is pitless viper.
2. Body is covered with keeled scales.
3. Head large, flat, triangular covered with small scales.
4. Body is thick set, followed by narrow neck, a thick trunk and a short pointed tail.
5. Head bears a very wide mouth and a pair each of nostrils and eyes.
6. Colour is brownish but it varies according to the environment.





Phylum - Chordata  
Class - Reptilia  
Order - Squamata  
Genus - Bungarus



Bungarus (krait)

for

## Bungarus (krait)

DATE
PAGE

### Classification:-

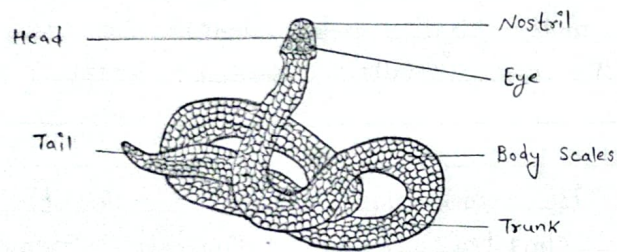
Phylum - chordata  
Class - Reptilia  
Order - Squamata  
Genus - Bungarus

Habit and Habitat:- Bungarus is found in South-east Asia, all over India. It is found under logs and stones. It is nocturnal and feeds on smaller snakes, lizards and mice.

### Characters:-

1. Bungarus is commonly known as krait.
2. Body is elongated and cylindrical, measuring 1-1.5 meter in length.
3. Colour of body is dark blue with yellow-white and black cross-bars.
4. Body scales are smooth. The dorsal scales are small while ventral scales extend fully across the ventral side.
5. Head is not differentiated from neck. Fangs small.
6. The arrangement of scales on head is used for identification of kraits.
7. Eyes with round pupils. Tongue bifid and protrusible.

Phylum - Chordata  
Class - Reptilia  
Order - Squamata  
Genus - Eryx



Eryx (Rat Snake)

*[Signature]*  
26/09/20

## Eryx (Rat Snake)

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### Classification:-

Phylum - Chordata  
Class - Reptilia  
Order - Squamata  
Genus - Eryx

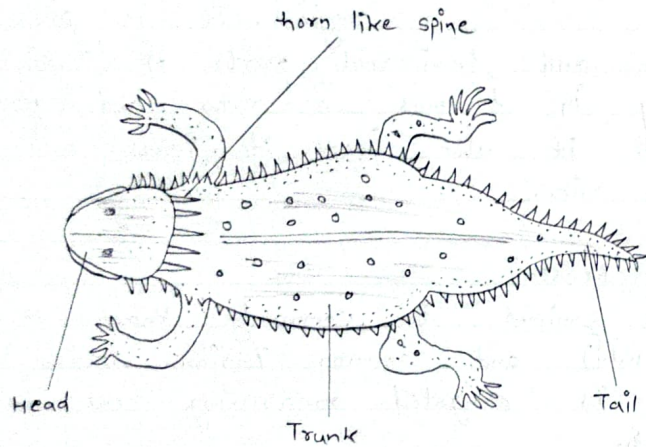
Habit and Habitat:- Eryx is found in sandy regions. It is present in arid and semi-arid parts of India and found living in burrows of rats and gerbils on which it also feeds. It feeds on lizards, frogs and mice.

### Characters:-

1. Eryx conicus is commonly known as Sand boa (Gumahi) and common Indian species is E. johnii.
2. It is elongated measuring one meter in length.
3. Body is thick and cylindrical, of a uniform brown colour, body is also covered with 40-45 rows of small scales.
4. Skin is covered with dorsally with small smooth scales and ventrally by slightly large plate-like scales.
5. Head scales are primitive and 3 scales enlarged.
6. Tail is head-like.



Phylum - chordata  
Class - Reptilia  
Order - Squamata  
Genus - Phrynosoma



Phrynosoma

fsr

Phrynosoma

Page No.	
Date	

#### Classification:-

Phylum - chordata  
Class - Reptilia  
Order - Squamata  
Genus - Phrynosoma

**Habit and Habitat:-** It is terrestrial lizard present in the deserts of South-western USA, Mexico and Eastern Washington. It lives on sandy and dry places. It can live without water for a long time.

#### Characters:-

1. It is commonly known as horned lizard.
2. Body is short and almost oblong in outline and gives the appearance of a toad.
3. Body is flat, broad and spiny also.
4. Scales of head region are enlarged like horns while spiny scales are found all over the body.
5. Under surface is covered with keeled scales.
6. Skin is dry which is covered with scales and produced into spines. These spines are present in rows from the head to the tip of the tail.
7. Eyes bear complete eyelids.
8. Tail is short and covered with spiny scales.

Phylum - Chordata  
Class - Reptilia  
Order - Chelonia  
Genus - Chelone

## Chelone

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### Classification:-

Phylum - Chordata

Class - Reptilia

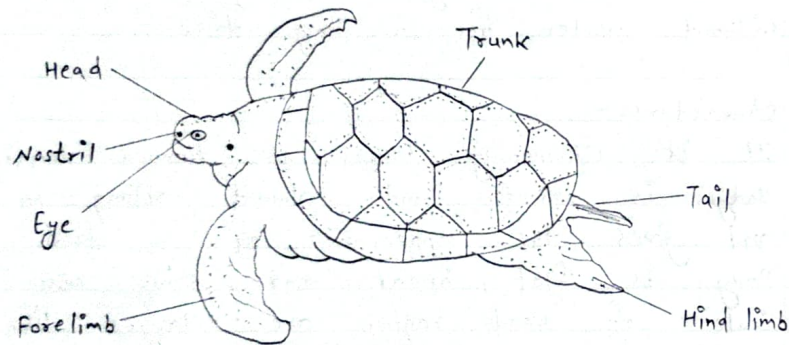
Order - Chelonia (Body encased in a shell, limbs clawed or webbed)

Genus - Chelone

Habit and Habitat:- It is distributed in tropical and subtropical regions and mainly found in the Indian, Pacific and Atlantic oceans and coasts of the United States.

### Characters:-

1. It is a marine reptile which is commonly known as green turtle.
2. It is large turtle of about 110 cm in length. Shell measures a meter in length.
3. Body case is rigid.
4. Body colour is mottled dark green above and pale yellow below.
5. Small head is attached to a long neck which is not completely retractile into a carapace.
6. Head is covered by single pair of prefrontal shields.
7. Tail is very short.

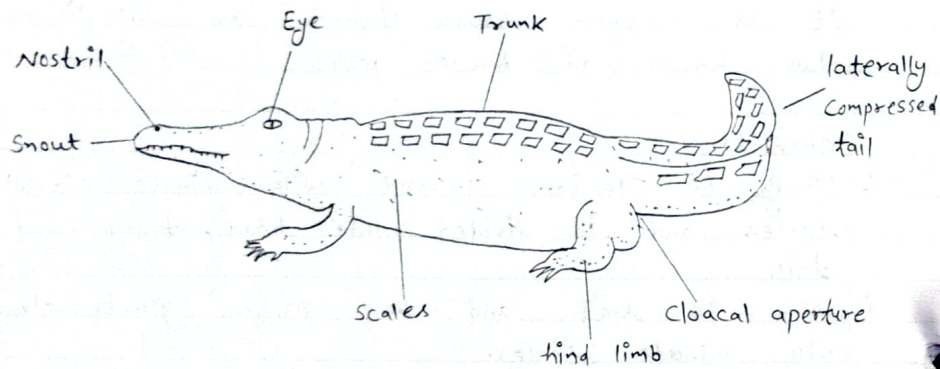


Chelone

JSR



Phylum - chordata  
class - Reptilia  
order - Crocodilia  
Genus - Alligator



Alligator

psw

## Alligator

DATE	
PAGE	

### Classification:-

Phylum - chordata

class - Reptilia

order - crocodilia (Body and head large, jaws powerful, skin thick and leathery, heart 4 chambered)

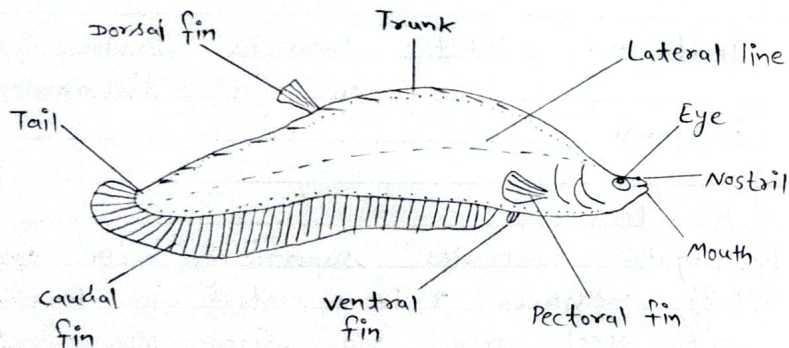
Genus - Alligator

Habit and habitat:- Inhabits shallow water and on slight disturbance buries in sand.

### characters:-

1. Alligator resembles superficially with crocodylus.
2. Body measures 3 to 4 metres in length. The upper part steel grey and sides olive green. Body divisible into head, neck, trunk and tail.
3. Body is covered with thick leathery skin containing scutes. The dorsal bony scutes do not articulate with each other. The ventral scutes are with or without very little ossification.
4. Head is broad and snout bluntly rounded.
5. Small ear opening is protected by a flap of skin and nasal bones divide nasal aperture.
6. Tail long, heavy compressed.

Phylum - chordata  
Class - Osteichthyes  
Order - Clupeiformes  
Genus - Notopterus



Notopterus

fss

## Notopterus

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### Classification:-

Phylum - chordata  
Class - Osteichthyes (Bony fish)  
Order - Clupeiformes (scales cycloid)  
Genus - Notopterus

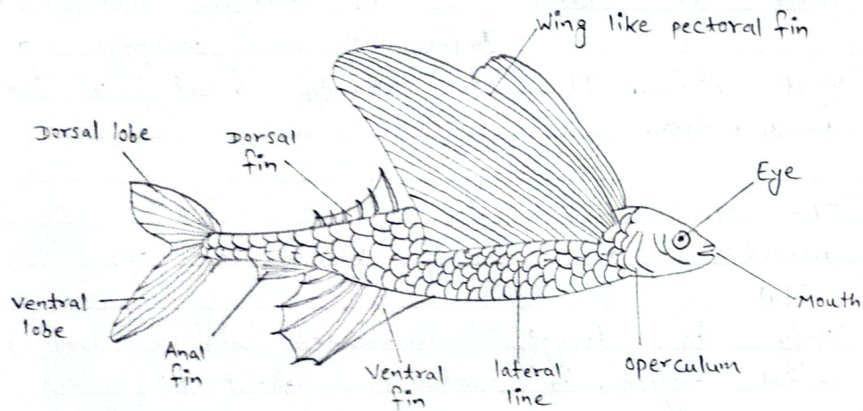
Habit and Habitat:- It is widely distributed in India, Burma, Malaya and West Africa. It is commonly found in lakes, fresh water.

### Characters:-

1. Notopterus is commonly known as cat-fish or chital.
2. Body is strongly compressed with a short pre caudal region, it measures about 1.5 meters in length.
3. Colour is silvery dark or greenish on the back.
4. Head contains large and oblique mouth, whitish eyes and nostrils.
5. Dorsal fin is short, anal fin is very much elongated.
6. Caudal fin is reduced and varies upto 85-100.
7. Pelvic fin has 3-4 rays.
8. They bear scaly gill cover.



Phylum - chordata  
class - Osteichthyes  
Order - Belontiiformes  
Genus - Exocoetetus



Exocoetetus

*psb*

## Exocoetetus

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Date	

### Classification:-

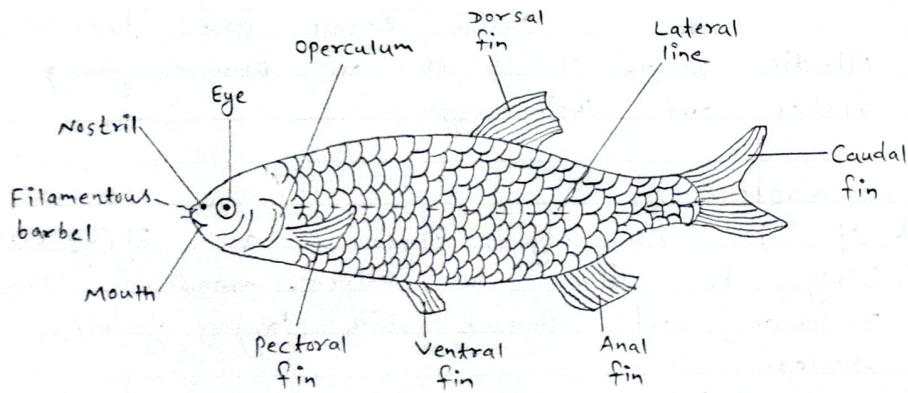
Phylum - chordata  
class - osteichthyes  
Order - Belontiiformes (scales cycloid, pectoral fins large)  
Genus - Exocoetetus

Habit and Habitat:- It is marine found in Indian Ocean and tropical Atlantic ocean. It feeds on prawns, young fishes and their eggs.

### Characters:-

1. It is commonly known as 'Flying Fish'.
2. Body is silvery in colour, measures about 30-40 cm and covered with large cycloid scales.
3. Head is large and blunt, but the jaws are not produced into a beak.
4. Eyes are large, nostrils are on sides, mouth is wide and toothed.
5. Pectoral fin is wing like and placed near the dorsal side.
6. The fins are used for gliding out of water. It can glide up to 400 meters, hence the name 'flying fish'.

Phylum - Chordata  
Class - Osteichthyes  
Order - Cypriniformes  
Genus - Labeo



Labeo rohita

fsr

Labeo

Page No.	
Date	

Classification:-

Phylum - Chordata

Class - Osteichthyes

Order - Cypriniformes (Anterior vertebrae fused, Weberian ossicles present between air bladder and ear)

Genus - Labeo

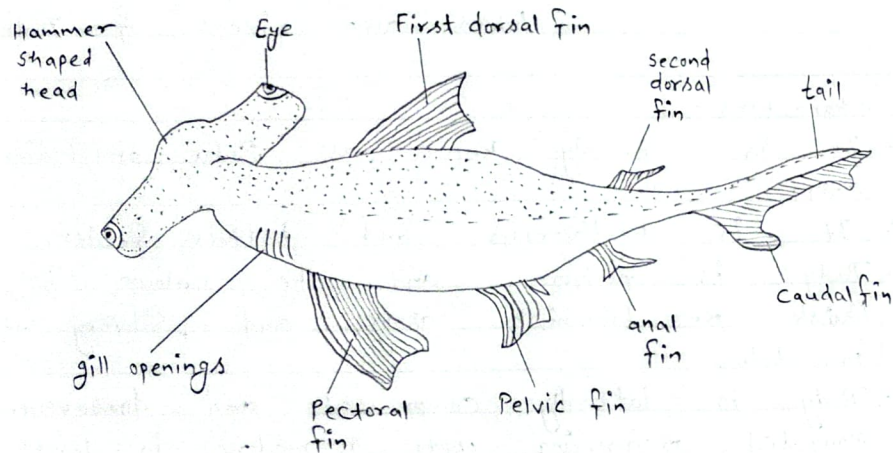
Habit & Habitat:- Fresh water fish found in lakes and rivers of India.

Characters:-

1. It is commonly known as 'Rohu' or Indian carp.
2. It is herbivorous and bottom feeder.
3. Body is fusiform and the colour is bluish or brownish above and silvery white in below.
4. Body is laterally compressed and dorsoventrally elongated measuring upto 2 metre in length.
5. Exoskeleton is of large cycloid scales.
6. Head is produced into a short and blunt snout covered with tubercles.
7. Mouth is sub-terminal and surrounded by thick and fleshy lips.
8. Median and paired fins have bony fin rays.



Phylum - Chordata  
 class - chondrichthyes  
 order - Pleurotremata  
 Genus - Sphyrna



Sphyrna

fsr

## Sphyrna: Hammer-headed Shark

Page No.	
Date	

### Classification:-

Phylum - chordata  
 class - chondrichthyes (Endoskeleton cartilaginous. Scales usually placoid. Spiral valve in intestine. Opercula absent)  
 Order - Pleurotremata (Gill slits lateral, pectoral fins small)

Genus - Sphyrna

Habit and Habitat:- Sphyrna or Zygaena or Reniceps is a common marine fish, adapted for deep sea waters. It is a voracious feeder and active swimmer. It eats small fishes, but because of its attacks on man, it is dreaded as man-eater.

### Characters:-

1. Commonly called as hammer-headed shark due to the hammer-shaped head, which is produced into two prominent lateral lobes.
2. Elongated body measuring 4 to 5 meters is divided into head, trunk and tail. The tail is raised upwards and contains Caudal fin.
3. Dorsal side is greyish while ventral side is yellowish.
4. Gill-slits 5 pairs and lateral in position. Spiracles are absent.

Phylum - chordata  
 Class - chondrichthyes  
 Order - Holocephalii  
 Genus - Chimaera

## Chimaera

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### Classification:-

Phylum - chordata

class - chondrichthyes

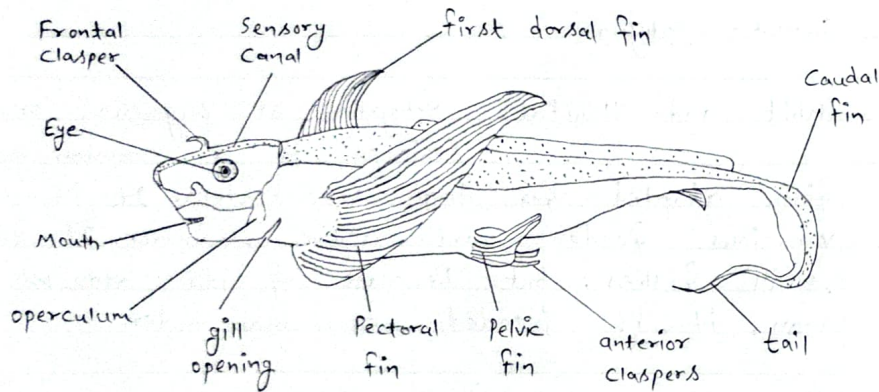
order - Holocephalii (Adults scaleless, operculum present cloaca absent)

Genus - chimaera

Habit and Habitat:- It is marine, found at the coastal regions of Pacific and Atlantic oceans.

### Characters:-

1. It is commonly known as 'rat fish', monster fish, elephant fish, and queen of herrings.
2. Exoskeleton is absent in adults.
3. Median and paired fins present. Dorsal fins are two and one small anal fin is present opposite to second dorsal fin.
4. Head bears a small ventral mouth surrounded by lips and containing crushing plates instead of teeth.
5. Head also bears a pair of lateral eyes and terminal single nasal aperture.
6. Skin is smooth without scales but in certain areas placoid scales are also present.
7. Both pectoral and pelvic fins are present.



Chimaera

*JS*



Phylum - Chordata  
Class - Osteichthyes  
Order - Ostariophysi  
Genus - Clarius

## Clarius (Magur)

Page No.	
Date	

### Classification:-

Phylum - Chordata

Class - Osteichthyes

Order - Ostariophysi (Anterior vertebrae fused.  
Weberian ossicles present between  
air bladder and Pairs)

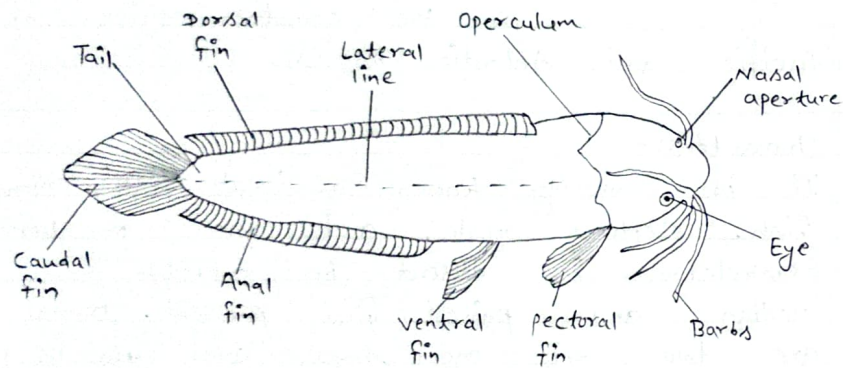
Genus - Clarius

Habit and Habitat:- Clarius batrachus is found in  
fresh and brackish waters.

It takes a wide variety of food including  
clams, insect larvae and crustaceans living in  
dirty ponds and muddy water. They act as  
scavengers.

### Characters:-

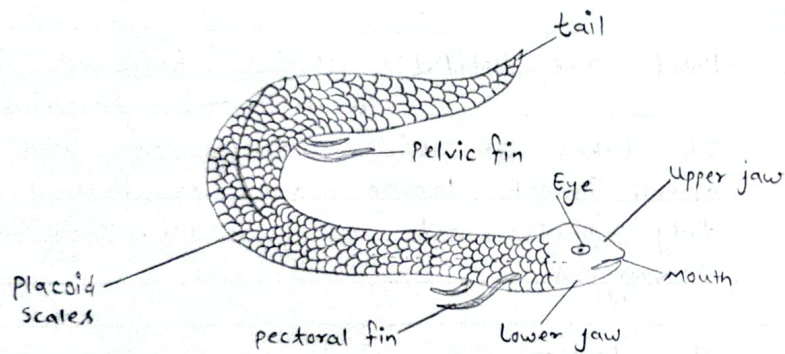
1. Commonly called as cat-fish or magur.
2. Body is divided into head, trunk and tail.
3. It is characterised by its spikeless dorsal fin, which extends all along the body from operculum to caudal fin.
4. Body is covered by scaleless and naked skin.
5. Spiracles absent. Lateral line distinct.
6. Tail is laterally compressed, diphyccercal and having rounded caudal fin.



Clarius

fss

Phylum - chordata  
class - osteichthyes  
Order - Dipnoi  
Genus - Lepidosiren



Lepidosiren

fsr

## Lepidosiren

Page No.	
Date	

### Classification:-

Phylum - chordata

Class - osteichthyes

Order - Dipnoi (Air bladder single or paired, lung like)

Genus - Lepidosiren

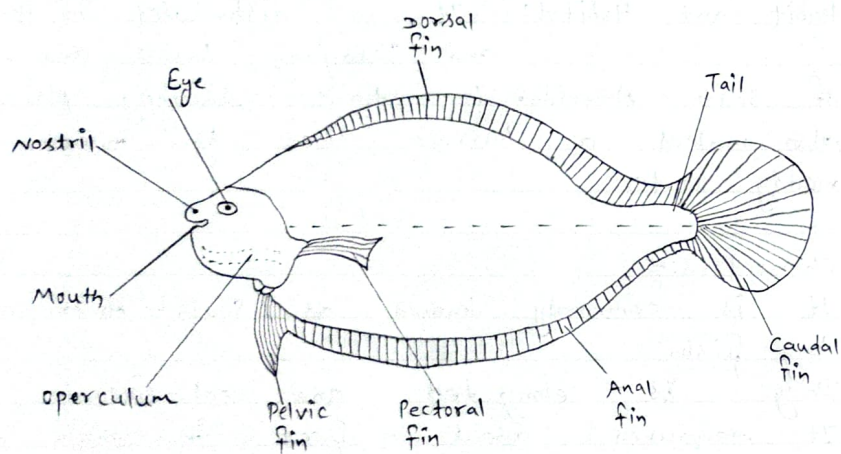
**Habit and Habitat:-** It is distributed in Amazon and Paraguay basins and plains of South America. It inhabits swampy places, also makes a burrow lined by mucus in muddy water.

### Characters:-

1. It is commonly known as South American lung fish.
2. Body is elongated and eel-like.
3. It measures about 3 feet in length and covered with cycloid scales.
4. Gill slits are 4 in number.
5. Eyes are very small.
6. Paired fins are reduced to slender styliform appendages formed of jointed axis.
7. Filaments are almost meant for respiration.
8. Caudal fin and anal fin are continuous.
9. Lateral line is distinct.



Phylum - Chordata  
Class - Actinopterygii  
Order - Pleuronectiformes  
Genus - Synaptura



Synaptura

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## Synaptura

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### Classification:-

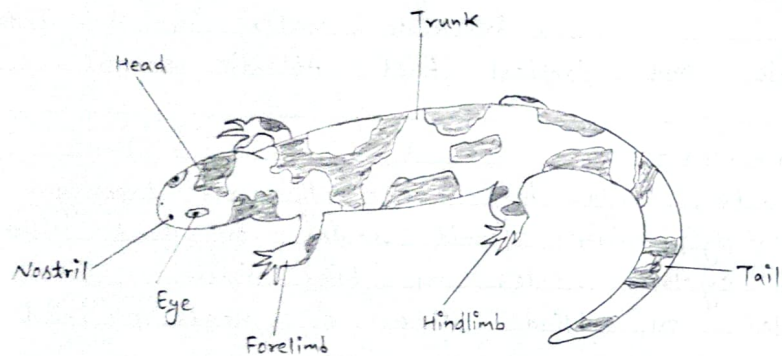
Phylum - Chordata  
Class - Actinopterygii (ray-finned fish)  
Order - Pleuronectiformes  
Genus - Synaptura

Habit and Habitat:- Mostly found in salt and brackish water in the Indo-Pacific and tropical East Atlantic ocean.

### Characters:-

1. Elongate, broad body anteriorly and tapering posteriorly, with ctenoid scales on eyed side, and cycloid scales on blind side.
2. Scales on blind side of head modified into cutaneous sensory processes.
3. Eyes on right side with scaly interorbital space.
4. Anterior part of snout with a bony process.
5. Mouth curved.
6. Dorsal and anal fins joined to caudal fin.

Phylum - Chordata  
Class - Amphibia  
Order - Urodela  
Genus - Ambystoma



Ambystoma

*psr*

## Ambystoma

Page No.	
Date	

### Classification:-

Phylum - Chordata

Class - Amphibia (Cold blooded, scaleless glandular skin, can live in water and land)

Order - Urodela (Have 2 limbs, scaleless amphibia with well developed tail, gills/lits present)

Genus - Ambystoma

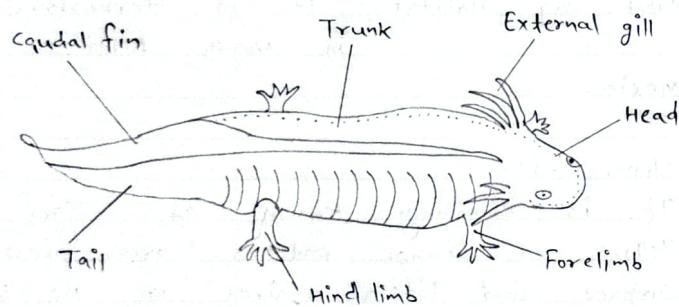
Habit and Habitat:- It is terrestrial and found in North America and Central Mexico.

### Characters:-

1. It is commonly known as 'Tiger Salamander'.
2. Yellow or orange patches are present on dorsal surface and lateral sides of the body.
3. Body is lizard like with smooth moist skin which is black in colour with yellow spots.
4. Body is divided into a large well developed head, neck, trunk and long slightly laterally compressed tail.
5. Head is flat and round tail is cylindrical and trunk has 12 intercostal grooves.
6. Eyes with moveable eyelids and nictitating membrane is present.
7. Fore and hind limbs are well developed with 4 or 5 digits.



Phylum - Chordata  
Class - Amphibia  
Order - Urodela  
Genus - Axolotal larva  
of Ambystoma



Axolotal larva

fsr

## Axolotal larva

Page No.	
Date	

### Classification:-

Phylum - Chordata  
Class - Amphibia  
Order - Urodela  
Genus - Axolotal larva of Ambystoma

Habit and Habitat:- It is larva of Ambystoma, completely aquatic and is found in mountain lakes of America and Mexico.

### Characters:-

1. It is perennial and its body is divisible into head, trunk and laterally compressed tail fin.
2. It has 3 pairs of external gills and 4 pairs of open gill clefts.
3. Head is large, blunt and bears a wide terminal mouth and pair of nostrils and eyes.
4. Eyes are without moveable eyelids.
5. Jaws are toothed and vertebrae amphicoelous.
6. Tail is laterally compressed and is provided with caudal fin.
7. Trunk bears well-developed fore and hind limbs.

Phylum - Chordata  
Class - Amphibia  
Order - Anura  
Genus - Hyla

## Hyla (Tree Frog)

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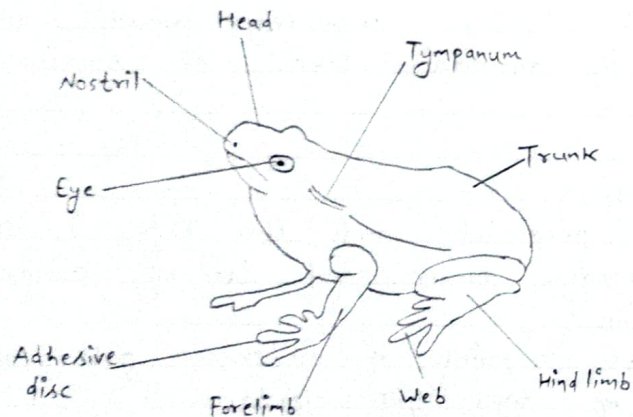
### Classification:-

Phylum - Chordata  
Class - Amphibia  
Order - Anura or Salientia  
Genus - Hyla

**Habit and Habitat:-** It is found on trees in damp tropical forests of the world, including India. It is commonly distributed in India, China, United States, Africa and Canada.

### Characters:-

1. It is commonly known as tree frog.
2. It is arboreal in nature and measuring 3-10 cm in size.
3. Body is divided into head and trunk.
4. Skin is moist on the dorsal surface and also smooth.
5. Papilla is present on the ventral side.
6. Colour of body varies according to the species may be green.
7. Head is triangular which joins with the slender trunk.
8. Eyes have moveable eyelids and tympanic membrane behind the eyes.

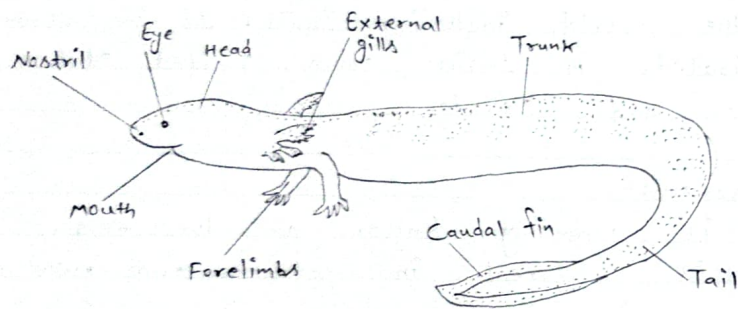


Hyla

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Phylum - chordata  
Class - Amphibia  
Order - Urodela  
Genus - Siren



Siren

fss

### Siren (Mud-Eel)

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#### Classification:-

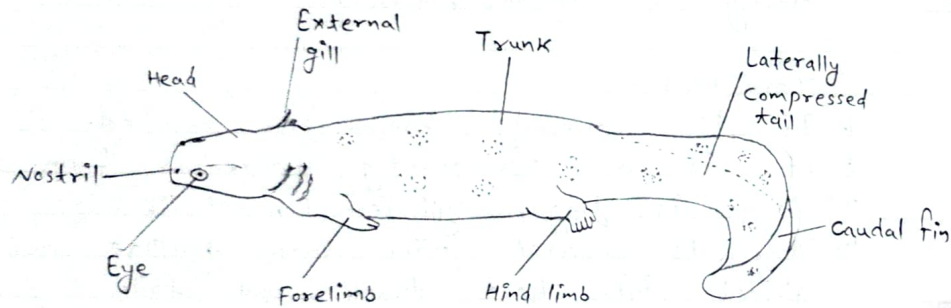
Phylum - chordata  
Class - Amphibia  
Order - Urodela  
Genus - Siren

Habit and Habitat:- It is found in burrows, muddy ditches and ponds, mainly in North America.

#### Characters:-

1. It is commonly known as mud eel.
2. It is a permanently neotenic form.
3. Body is long, cylindrical, eel like.
4. Body is covered with small papillae and is divided into head, trunk and tail.
5. Skin is moist, smooth, and pigmented and of blackish colour.
6. Head bears terminal mouth or conical in shape with small eyes and nostrils.
7. Eyes are without eyelids.
8. Tail is thick and provided with small caudal fin.
9. Gill slits are of one pair.
10. Cloacal glands are absent.

Phylum - Chordata  
Class - Amphibia  
Sub-order - Proteidae  
Genus - Necturus



Necturus

fs  
26/09/24

## Necturus (Mud-puppy)

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Date	

### Classification:-

Phylum - Chordata

Class - Amphibia

Sub-order - Proteidae (Adults with 3 pairs of external gills, without eyelids)

Genus - Necturus

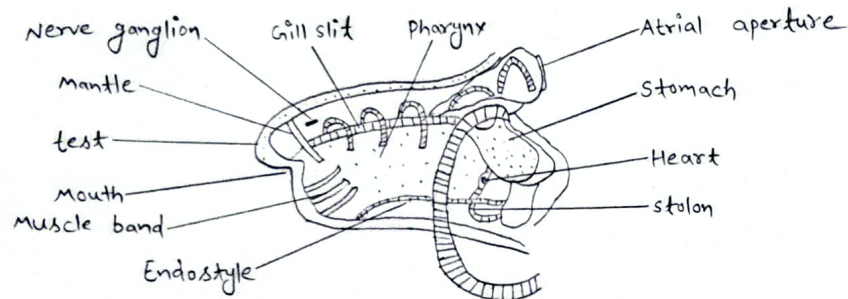
Habit and Habitat:- It is nocturnal, bottom dweller North American fresh water amphibian.

### Characters:-

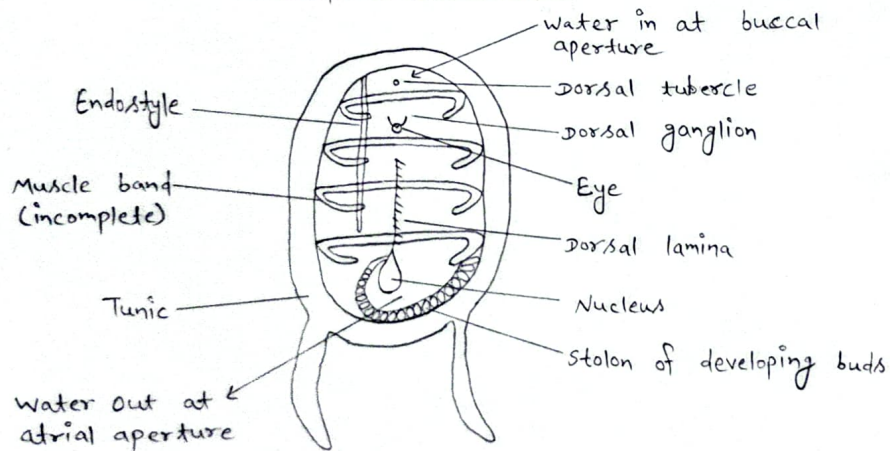
1. It is commonly known as 'Mud Puppy'.
2. It is dark brown in colour with a few black spots on its body.
3. Body is divisible into head, trunk and tail.
4. Rectangular head and elongated trunk are dorsiventrally flattened but tail is laterally compressed and has tail fin.
5. Hind and forelimbs are weak and have 4 digits.
6. Eyes are small and without lids.
7. It represents permanent neotenic larval stage.



Phylum - chordata  
Class - Thaliacea  
Order - Salpida  
Genus - Salpa



Salpa (Lateral view)



Salpa

Salpa

Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
Page \_\_\_\_

classification:-

Phylum - chordata (Nerve cord, Notocord and gill-slits present.)  
Class - Thaliacea (Tunic permanent, transparent with circular muscle.)

Order - Salpida (Incomplete muscle bands, no larva.)  
Genus - Salpa

Habit and Habitat:- Salpa is a cosmopolitan, marine and typical pelagic acidian distributed in almost all seas.

characters:-

1. It is dimorphic exhibits alternation of generations. Its solitary phase is asexual oozoid, while gregarious phase is sexual gonozoid or blastozoid.

oozoid:-

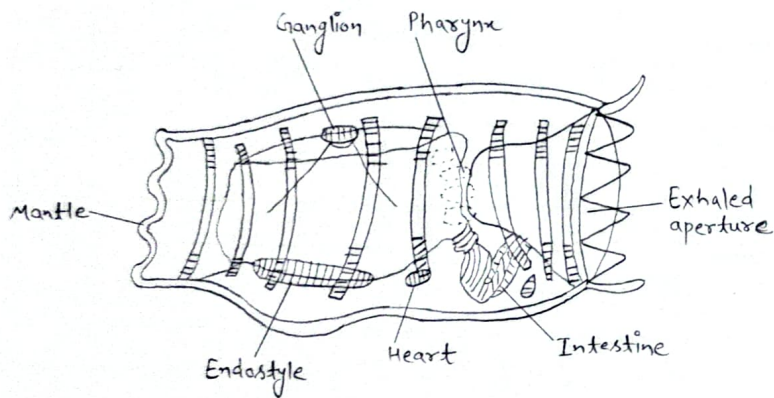
- (i) It is prism like bilaterally symmetrical and having branchial (mouth) and atrial (anus) apertures at opposite ends.
- (ii) Test is thin and transparent.
- (iii) Near the brain is a single ocellus.

Blastozoid:-

- (i) Sexual blastozoid has a general structure like asexual oozoid.
- (ii) It is smaller, asymmetrical with no test processes.
- (iii) Number of muscle bands is fewer.

Teacher's Sign .....

Phylum - Chordata  
 Class - Thaliacea  
 Order - Doliolida  
 Genus - Doliolum



Doliolum Oozoid

*[Red signature]*

## Doliolum

Date     /    /      
 Page     

### Classification:-

Phylum - Chordata

Class - Thaliacea

Order - Doliolida (Muscle bands form 3 complete rings, larva present.)

Genus - Doliolum

Habit and Habitat:- Doliolum is a cosmopolitan, marine, free swimming and pelagic, thaliacean distributed in almost all seas.

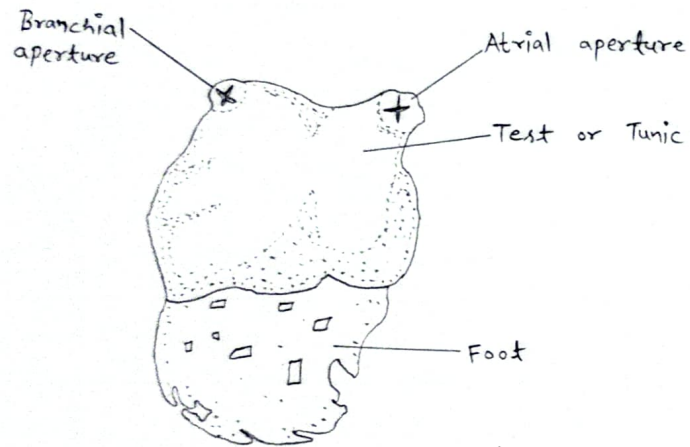
### Characters:-

1. Oozoid is a colonial asexual gregarious phase of Doliolum.
2. It is barrel shaped, having wide branchial and atrial aperture at opposite ends each surrounded by 10-12 lobes.
3. The mantle containing 3 muscle bands completely encircling the body and the terminal ones work as sphincters.
4. The animals move by jet propulsion driving out water through atrial aperture by contraction of muscle.
5. Mouth leads into a pharynx having several stigmata only in its posterior wall it has an endostyle, but there is no dorsal lamina.

Teacher's Sign



Phylum - chordata  
Class - Ascidiacea  
Order - Ascidiacesimplices  
Genus - Herdmania



Herdmania

## Herdmania

Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
Page \_\_\_\_

### Classification:-

Phylum - Chordata  
Class - Ascidiacea (Tunic with scattered muscles, many gill-slits.)  
Order - Ascidiacesimplices (Fixed solitary, unisexual one)  
Genus - Herdmania

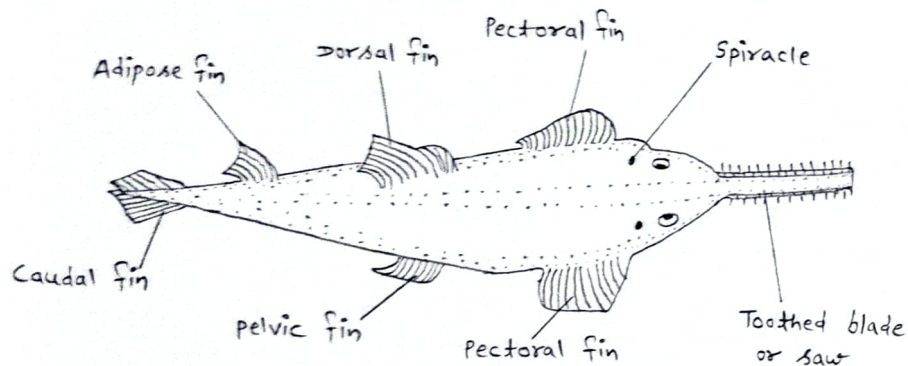
Habit and Habitat:- Herdmania is basically marine living organism, which is commonly found in seawater.

### Characters:-

1. It is marine, segmented and solitary animal.
2. The body look like square and enclosed in a soft transparent tunic 'the test'.
3. The tail is absent in adults or they are without tail.
4. The individuals are attached to substratum through foot.
5. Alimentary canal is almost 'U' shaped.
6. The mouth and cleaca open into definite chambers - the branchial and atrial siphons.
7. Pharynx is perforated with paired stigmata in young and adults both.
8. Vascular system is of open type.
9. nervous system is represented by single ganglion in adults.

Teacher's Sign \_\_\_\_\_

Phylum - Chordata  
Class - Chondrichthyes  
Order - Hypotremata  
Genus - Pristis



Pristis

*AS*

## Pristis

Date     /    /      
Page     

### Classification:-

Phylum - chordata  
class - chondrichthyes (Endoskeleton cartilaginous, spiral valve in intestine.)  
Order - Hypotremata (Gill-slits ventral, spiracles present.)  
Genus - Pristis

Habit and Habitat:- It is marine fish, commonly found in seawater.

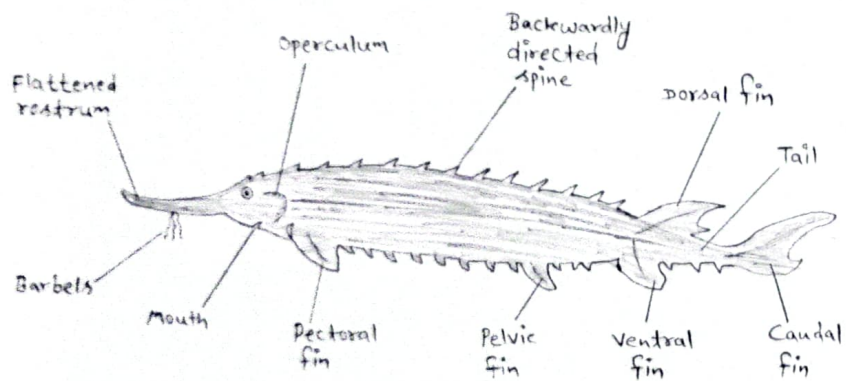
### Characters:-

1. It is commonly known as 'saw-fish'.
2. Body is elongated with spindle shaped.
3. Exoskeleton is made up of placoid scales.
4. Head is produced into a long, beak-like and flat rostrum having tooth-like lateral denticles to work as saw. It is used for offence, defence and food capture.
5. Median and paired fins are present and pectoral fins are small.
6. Males have paired claspers.
7. Two dorsal fins and one anal fin are present. First dorsal fin is just opposite to pelvic fin.
8. Heterocercal tail bears single lobed caudal fin.
9. It is viviparous in nature.

Teacher's Sign



Phylum - Chordata  
Class - Osteichthyes  
Order - Acipenseriformes  
Genus - Acipenser



Acipenser

*Handwritten signature*

## Acipenser

Date \_\_\_\_\_  
Page \_\_\_\_\_

### Classification:-

Phylum - Chordata  
Class - Osteichthyes (Bony fish)  
Order - Acipenseriformes (Body with ganoid scales, heterocercal tail)  
Genus - Acipenser

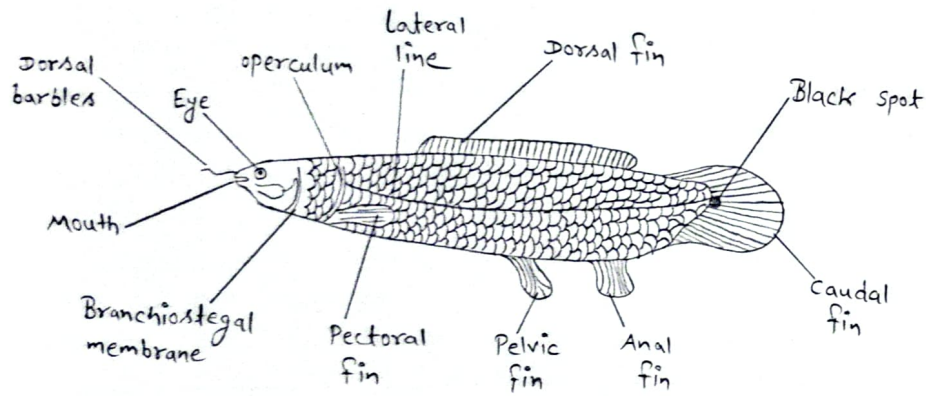
Habit and Habitat:- Primitive ganoid fish which lives in the sea, but comes to the rivers of North America, North Asia and Europe for breeding.

### Characters:-

1. It is marine, anadromous (lives in freshwater for breeding) and carnivorous fish and commonly known as 'sturgeon'.
2. Body is fusiform with the head produced into a long pointed snout having ventral barbels.
3. Head bears a ventral mouth with reduced toothless jaws. Head is large, it is produced into a tubular snout.
4. Exoskeleton is in the form of dermal rings.
5. Tail is heterocercal, long and prehensile.
6. Gill slits are in the form of small rounded apertures and are covered by operculum.
7. Median and paired fins are made of dermal fin rays.

Teacher's Sign \_\_\_\_\_

Phylum - chordata  
class - Osteichthyes  
Order - Amiiformes  
Genus - Amia



Amia calva

*Handwritten signature/initials in red ink.*

## Amia

Date     /    /      
Page     

### Classification:-

Phylum - chordata

class - Osteichthyes

Order - Amiiformes (Cycloid scales on trunk, ganoid scales on head)

Genus - Amia

Habit and Habitat:- It lives in freshwater, it is primitive ganoid fish found in rivers and lakes of North America.

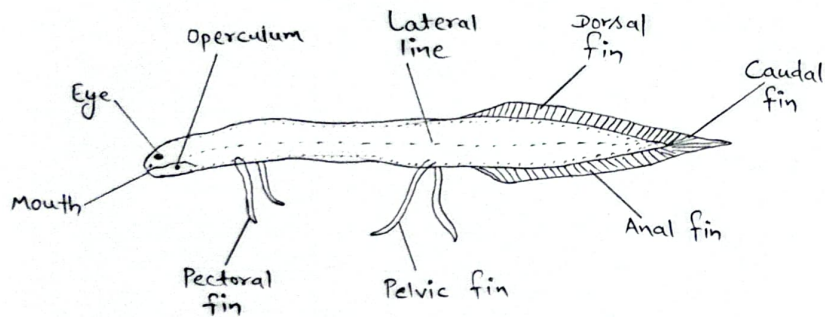
### Characters:-

1. It is commonly known as bow-fish.
2. Body is laterally compressed which measures about 60 cm in length.
3. Head has a wide terminal mouth containing teeth, a pair of lateral eyes, and dorsolateral terminal nostrils. Spiracles are absent.
4. Body scales overlap each other and appears cycloid type. Head bears ganoid scales.
5. Paired pectoral and pelvic fins and the unpaired median single dorsal, caudal and anal fins are present.
6. The dorsal fin is continuous long fin and hence the name 'bow-fish'.
7. Tail is homocercal.
8. It is carnivorous fish and exhibits parental care.

Teacher's Sign



Phylum - Chordata  
Class - Osteichthyes  
Order - Dipnoi  
Genus - Protopterus



Protopterus

*Handwritten signature in red ink.*

### Protopterus

Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
Page \_\_\_\_\_

#### Classification:-

Phylum - Chordata  
Class - Osteichthyes  
Order - Dipnoi (Air bladder single or paired.)  
Genus - Protopterus

Habit and Habitat:- It is freshwater mainly found in rivers and lakes of western Africa.

#### Characters:-

1. Body is elongated, cylindrical and measures about 25 cm in length.
2. Head bears a terminal mouth with dental plates in place of teeth, a pair of lateral small eyes, external nostrils and internal nostrils which opens into the mouth.
3. Paired pectoral and pelvic fins are thin, long and lobed.
4. Dorsal and anal fins are absent but sometimes dorsal fin fuses with caudal fin.
5. Tail is diphyccercal having 3 lobes with the central lobe projecting out.
6. Paired gill-clefts covered with opercula behind the head.
7. It bears a pair of lungs, trachea and glottis and a blood supply of pulmonary artery and

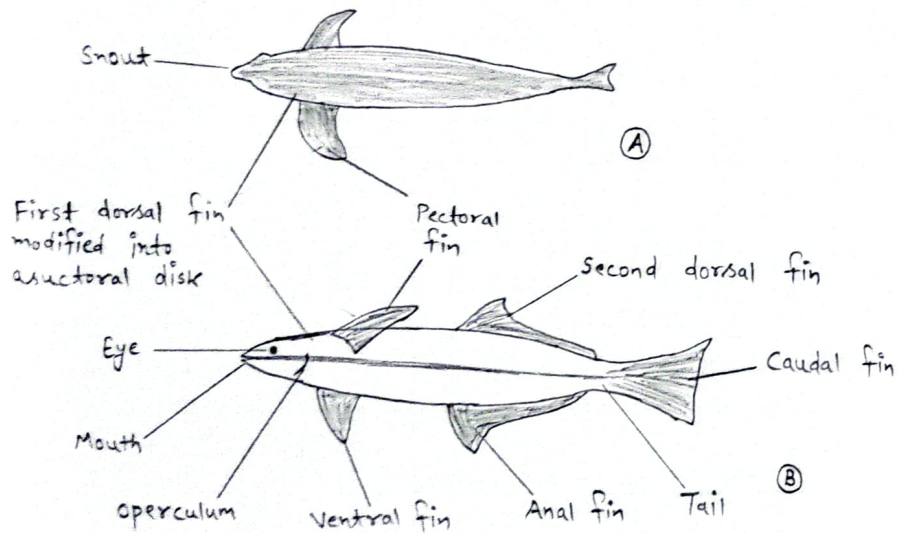
Teacher's Sign \_\_\_\_\_

vein.

8. It depends mainly on lungs for respiration.
9. It can live without water by aestivating in mud-tubes for as long as 6 months when the rivers dry up.



Phylum - chordata  
Class - Osteichthyes  
Order - Echeiniiformes  
Genus - Echeneis



Echeneis : (A) dorsal view (B) lateral view

*Handwritten signature*

## Echeneis

Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
Page \_\_\_\_

### Classification:-

Phylum - chordata

Class - Osteichthyes

Order - Echeiniiformes (Dorsal fin forms a sucker,  
no air bladder)

Genus - Echeneis

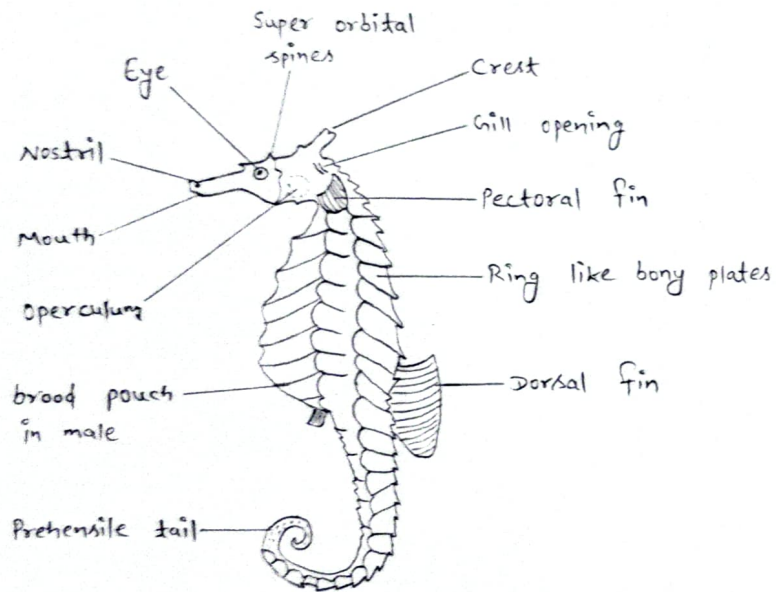
Habit and Habitat:- It is marine in form, found  
in tropical and sub-tropical seas.

### Characters:-

1. It is commonly known as 'Sucker-fish'.
2. Body is elongated measuring about 50 cm and covered with small scales.
3. Anterior part of the median dorsal fin is modified into a suckorial transversely laminated oral disc for attachment.
4. Lower jaw is large and the mouth is upturned.
5. It shows commensalism with sharks, to which it attaches by its oral disc for food and also for transport from one place to another.

Teacher's Sign \_\_\_\_\_

Phylum - Chordata  
 Class - Osteichthyes  
 Order - Syngnathiformes  
 Genus - Hippocampus



Hippocampus (Sea Horse)

*KS*

## Hippocampus

Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
 Page \_\_\_\_

### Classification:-

Phylum - Chordata  
 Class - Osteichthyes  
 Order - Syngnathiformes (Snout tubular, brood pouch present)  
 Genus - Hippocampus

Habit and Habitat:- It is marine fish, found in the Indian and Atlantic oceans at the bottom near the coast in the sea-weed. It is found in tropical and temperate seas.

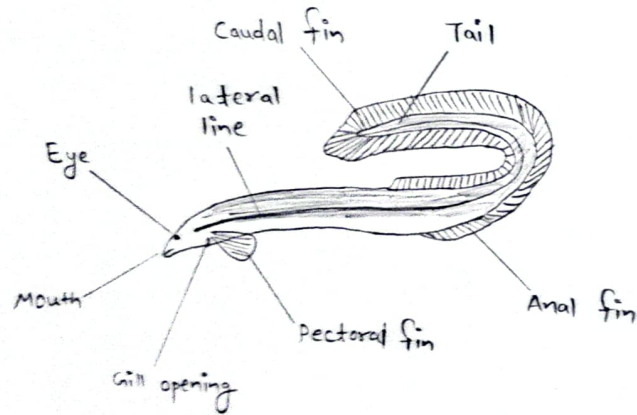
### Characters:-

1. It is commonly known as 'sea horse' because its snout appears like a horse.
2. Body is modified extremely and is covered completely by large shield-like bony scales.
3. A Head is large and is right angles to the body. It is produced into a tubular snout.
4. Head is produced into a tooth-less snout or rostrum and resembles a horse's head.
5. Exoskeleton is in the form of dermal rings.
6. The pectoral fins are reduced and lie just behind the operculum.
7. The pelvic fins are absent.
8. Mouth is edentulous and suctional.
9. Lobebranch gills are made of many small rounded lobes.

Teacher's Sign \_\_\_\_\_



Phylum - Chordata  
Class - Osteichthyes  
Order - Anguilliformes  
Genus - Anguilla



Anguilla

*RS*

## Anguilla

Date / /  
Page

### Classification:-

Phylum - Chordata

Class - Osteichthyes

Order - Anguilliformes (Snake like body, scales vestigial or absent)

Genus - Anguilla

Habit and Habitat:- It is found in the rivers, lakes and ponds of Europe and America. Anguilla bengalensis is found in India.

### Characters:-

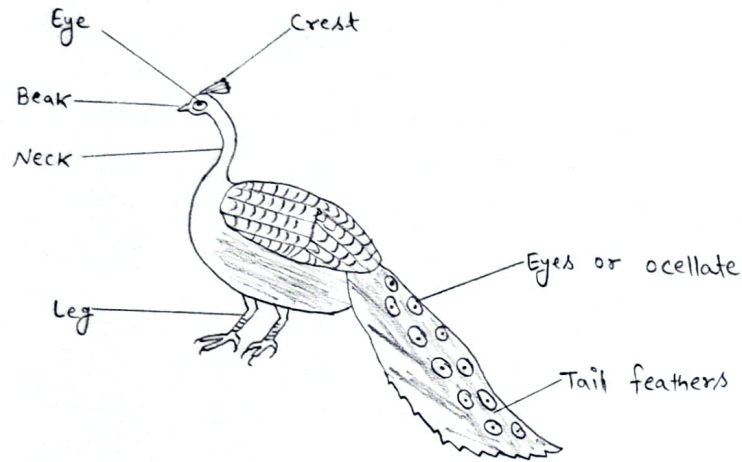
1. It lives in marshes and commonly known as 'European Eel'.
2. Body is elongated, cylindrical and eel like.
3. Body is long snake-like yellow green in colour and about 1 meter in length.
4. Skin is naked but rudimentary scales are buried in skin.
5. Paired and median fins have only branched rays.
6. Pectoral fin is reduced and pelvic is entirely absent.
7. The median fins that is dorsal, caudal, and anal fins are continuous.
8. Minute and round gill openings are present on the sides and are covered by operculum.
9. Air bladder is closed.

Teacher's Sign \_\_\_\_\_

Phylum - Chordata  
Class - Aves  
Order - Galliformes  
Genus - Pavo

Pavo

Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
Page \_\_\_\_\_



Pavo cristatus

*KS*

#### Classification:-

Phylum - Chordata  
Class - Aves (Bipedal, feather-clad)  
Order - Galliformes (massive scratching feet)  
Genus - Pavo

Habit and Habitat:- It is found in forests, jungle and various areas of India. It feeds on grains, small reptiles and insects.

#### Characters:-

1. Pavo cristatus is commonly known as pea-fowl or peacock in Hindi it is called Mor.
2. It is national bird of India and It is protected animal.
3. Head bears a short beak and crest of feathers on top.
4. Legs are strong and feet have sharp claws.
5. Males bear fighting spurs on the legs.
6. It is capable of flight of very short distances as the wings cannot efficiently support the heavy and large body.
7. It displays a well marked sexual dimorphism.
8. Male bird is beautifully pigmented with fan-shaped crest, brilliant metallic blue head, neck and breast.
9. Female is duller having lower neck metallic green.

Teacher's Sign \_\_\_\_\_

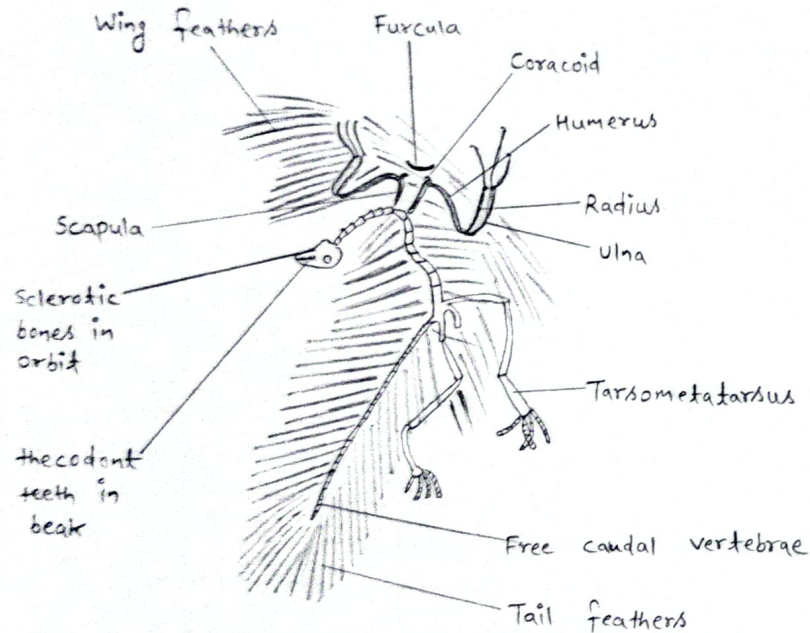


instead of blue as in male and lacks the ornamental tail.

10. Peahen is less beautiful. It has a crest on the head, but lacks the train of beautifully ocellated feathers.
11. Feet adapted for scratching and running.
12. They live in groups or families.

Teacher's Sign .....

Phylum - chordata  
class - Aves  
Subclass - Archaeornithes  
Genus - Archaeopteryx



Archaeopteryx

~~XSS~~  
1/10/24

## Archaeopteryx

Date \_\_\_\_\_  
Page \_\_\_\_\_

### Classification:-

Phylum - chordata

Class - Aves

Subclass - Archaeornithes (Extinct, teeth present, sternum without keel)

Genus - Archaeopteryx

### Characters:-

1. It is oldest known fossil bird and was discovered from upper Jurassic period in 1821 from Bavaria, Germany.
2. It forms a connecting link between reptiles and birds and exhibits many characters.
3. It was typical bird about size of crow.
4. Body was covered with feathers except the head and neck.
5. Forelimbs were typically modified as wings and were covered with flight feathers.
6. Jaws possessed small equal-sized pointed thecodont teeth.
7. Tail was long with more than 13 separate caudal vertebrae.
8. Reptilian characters possess:-
  - (a) Epidermal scales over body and limbs.
  - (b) Simple brain, cylindrical cerebral hemispheres and unexpanded cerebellum.
  - (c) Jaws with peg-like homodont teeth lodged in

Teacher's Sign



sockets.

(d) Vertebrae amphicoelous.

9. Avian characters possess:-

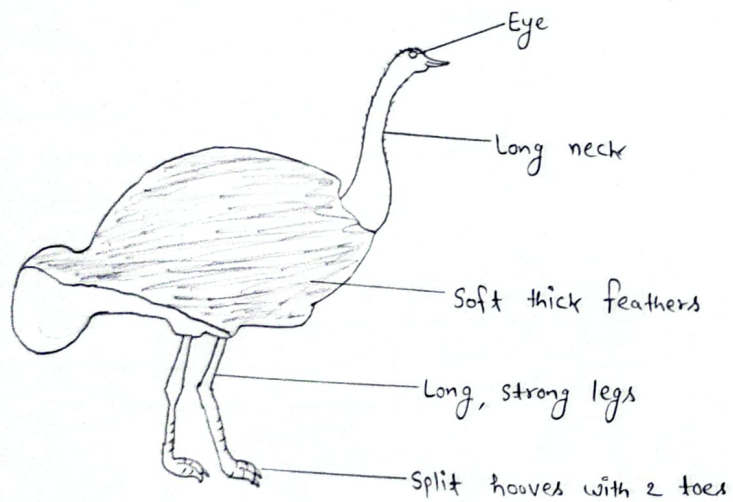
(a) Presence of feathers.

(b) Two jaws like beak.

(c) Skull monocondylic.

(d) Two clavicles fused into V shaped furcula.

Phylum - Chordata  
Class - Aves  
Order - Struthioniformes  
Genus - Struthio



Struthio (Ostrich)

*[Red signature]*

## Struthio (Ostrich)

Date     /    /      
Page     

### \* Classification:-

Phylum - Chordata  
Class - Aves  
Order - Struthioniformes  
Genus - Struthio

\* Habit and Habitat:- It is a flightless bird native to certain large areas of Africa and is the largest living bird species.

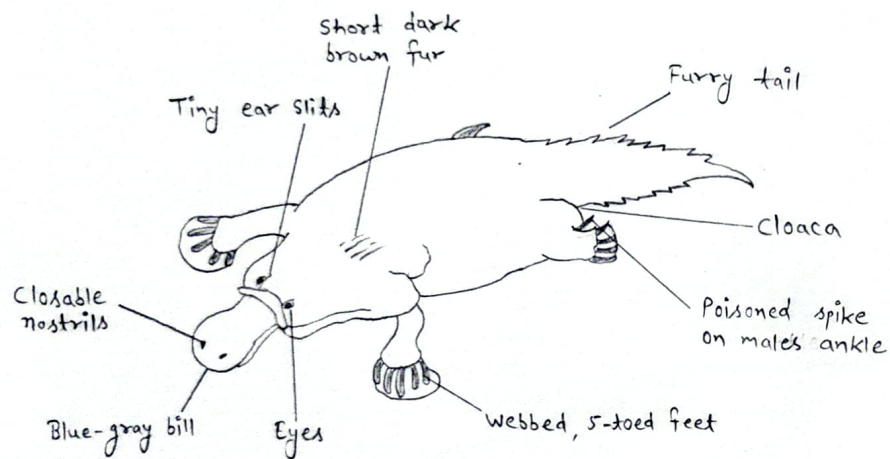
### \* Characters:-

1. The feathers of adult males are mostly black, with white primaries and a white tail.
2. Females and young males are grayish-brown and white.
3. The head and neck of both male and female ostriches are nearly bare, with a thin layer of down.
4. Their eyes are said to be the largest of any land vertebrate.
5. The strong lakes of the common ostrich are unfeathered and show bare skin, with the toes being covered in scales.
6. New chicks are fawn in color, with dark brown spots.
7. It is the largest living species of bird. It lays the largest eggs of any living bird.

Teacher's Sign



Phylum - Chordata  
Class - Mammalia  
Order - Monotremata  
Genus - Ornithorhynchus



Ornithorhynchus

*[Handwritten signature]*

## Ornithorhynchus (Duck-bill)

Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
Page \_\_\_\_

### \* Classification:-

Phylum - Chordata

Class - Mammalia (Hair clad, mammary glands present)

Order - Monotremata (Cloacal opening present)

Genus - Ornithorhynchus

\* Habit and Habitat:- It is found in South-eastern Australia and Tasmania. It is aquatic burrowing mammal native to rivers, freshwater lakes and ponds. It feeds on freshwater invertebrates.

### \* Characters:-

1. It is commonly known as 'duck-billed platypus'.
2. It measures about 50-70 cm in length.
3. Body is divided into head, thick trunk and tail.
4. Body is covered with short fur, dark brown colour.
5. They possess primitive reptilian characters and described as connecting link between reptilia and Mammalia.
6. Adults are without teeth and have a duck-bill.
7. Jaws are covered with horny plates.
8. Head bears small eyes with nictitating membrane.
9. Ear openings are without external pinnae.
10. Mammary glands without nipples.
11. Limbs have 5 clawed and webbed digits.
12. Feet are webbed and males possess a spur like spur on heel which is connected to a

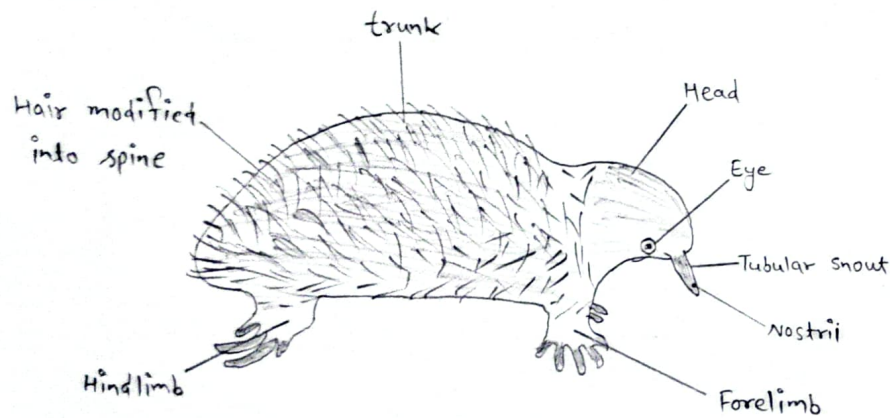
Teacher's Sign \_\_\_\_\_

Poison gland.

- 13. Tail is flat and helps in swimming.
- 14. cloaca present. Testes abdominal.
- 15. Penis conducts only sperms



Phylum - chordata  
Class - Mammalia  
Order - Monotremata  
Genus - Echidna



Echidna

*for*

## Echidna (Spiny anteater)

Date     /    /      
Page     

### \* Classification:-

Phylum - chordata  
Class - Mammalia  
Order - Monotremata  
Genus - Echidna

\* Habit and Habitat:- It is found in Australia, Tasmania and New Guinea. It feeds on ants.

### \* Characters:-

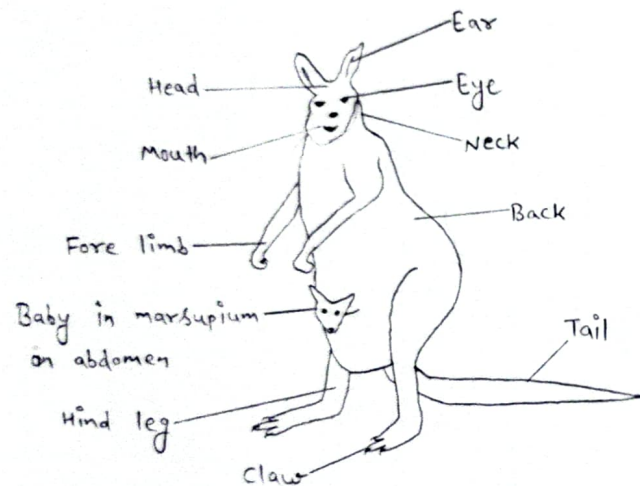
1. It is commonly known as 'spiny anteater'.
2. Neck and body indistinct.
3. Body is covered with strong pointed spines and hairs.
4. Head small and produced into a small tubular pointed snout.
5. Head bears an elongated cylindrical toothless beak and a pair of eyes without nictitating membrane.
6. External ears absent.
7. Limbs are short and have 3-5 digits with claws.
8. Tongue long and sticky, teeth absent in adult.
9. Girdles and limbs reptile like. Feet without web.

Teacher's Sign

10. Female lays one egg which is carried and incubated in a pouch or marsupium on the abdomen.



Phylum - Chordata  
Class - Mammalia  
Order - Marsupialia  
Genus - Macropus



Macropus (Kangaroo)

180

## Macropus (Kangaroo)

Date     /    /      
Page     

### \* Classification:-

Phylum - Chordata  
Class - Mammalia  
Order - Marsupialia (Female with marsupium)  
Genus - Macropus

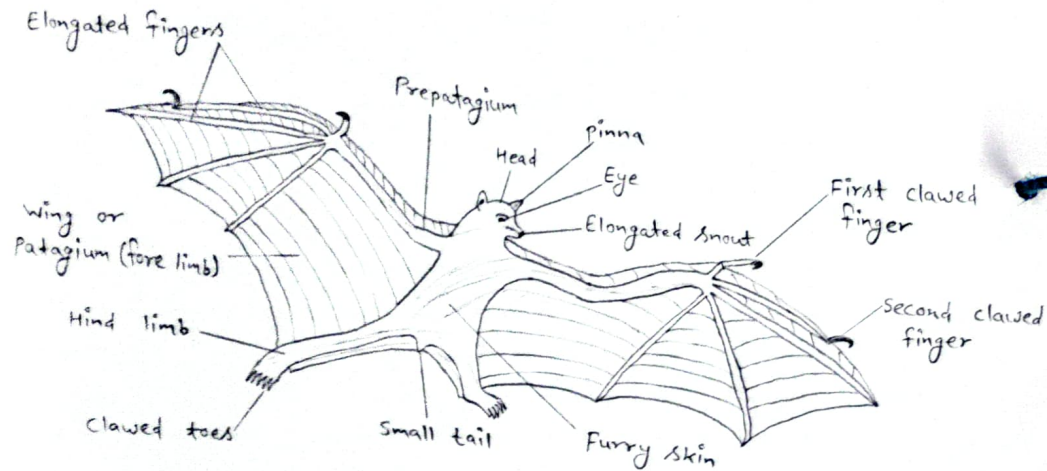
\* Habit and Habitat:- Kangaroos are found in Australia, New Zealand. They are terrestrial, gregarious, herbivorous animals.

### \* Characters:-

1. They are commonly called as kangaroos.
2. Kangaroos are large marsupials and reach height upto 2 meters. Males are about 6ft. and females are 4 ft. tall.
3. Head small but ears are large.
4. Hind legs and feet very long and powerful.
5. Forelimbs are small and do not touch the ground.
6. Hindlimbs digits 4 in number while forelimbs digits 5.
7. Tail is long, powerful, thick and used as a support when animal rests on the ground.
8. Females have an abdominal marsupial pouch in which the young one is nourished.
9. Hallux absent.

Teacher's Sign

Phylum - Chordata  
Class - Mammalia  
Order - Chiroptera  
Genus - Pteropus



Pteropus (Bat)

*for*

## Pteropus (Bat)

Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
Page \_\_\_\_

### \* Classification:-

Phylum - Chordata

Class - Mammalia

Order - Chiroptera (Forelimbs modified into wings)

Genus - Pteropus

\* Habit and Habitat:- It is found in South-Eastern Asia. It feeds on fruits and damage orchards.

### \* Characters:-

1. It is commonly known as Bat.
2. They sleep by day on tree.
3. It is nocturnal and hangs by its legs on high trees.
4. Body is dark brown coloured and shoulders are golden yellow.
5. Forelimbs are modified into wings.
6. Body measures about 60-70 cm in length and is covered with hair which is black on head.
7. Head is fox-like with a snout.
8. Head bears small external ears, large eyes, snout and small teeth.
9. Each wing formed a fold of skin or patagium supported by elongated forelimb.
10. Hindlimbs and tail also included in patagium.
11. Tail small and stumpy.

Teacher's Sign \_\_\_\_\_



Phylum - Chordata  
Class - Mammalia  
Order - Hyracoidea  
Genus - Procavia

## Procavia (Hyrax)

Date     /    /      
Page     

### \* Classification:-

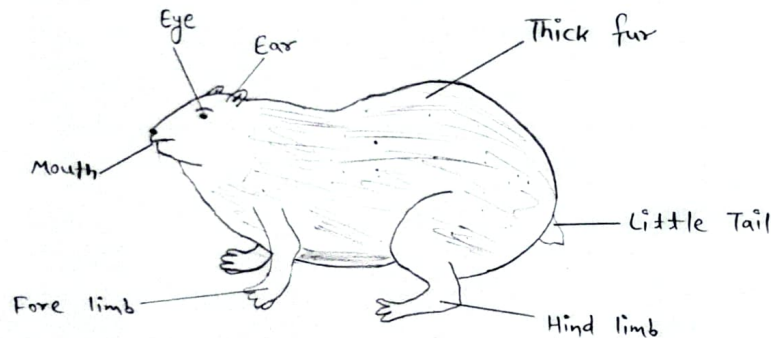
Phylum - Chordata  
Class - Mammalia  
Order - Hyracoidea  
Genus - Procavia

Habit and habitat:- The rock hyraxes are highly sociable animals, forming groups of 2-26 individuals.

### \* Characters:-

1. The rock hyrax is an unusual creature that lacks tail.
2. The coat of this animal is dense and varies greatly in color.
3. On its back, the Rock hyrax exhibits a characteristic marking colored in black, yellow or orange. Underneath this patch, the animal has a special gland, giving off a special odor.
4. The hyrax also possesses moist and rubber-like foot soles, allowing it to easily grasp objects when climbing steep rocks of its range.
5. The eye shape of the Rock hyrax is rather unusual: the iris projects from the pupil of the eye, acting as a built-in sun visor due to limiting the flow of light to the eye from above.
6. The Rock hyrax is also known as 'Pussie'.

Teacher's Sign                     

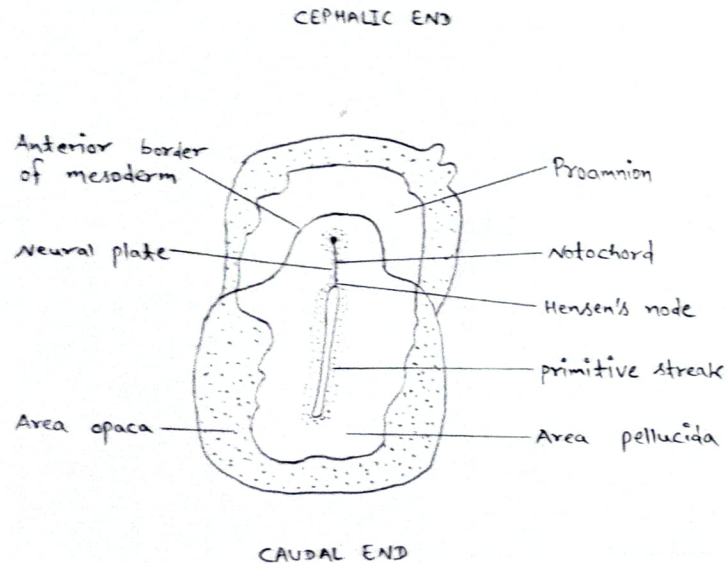


Procavia (Hyrax)

*pm*

Chick embryo - 18 hours (whole mount)

Date    /   /     
Page    



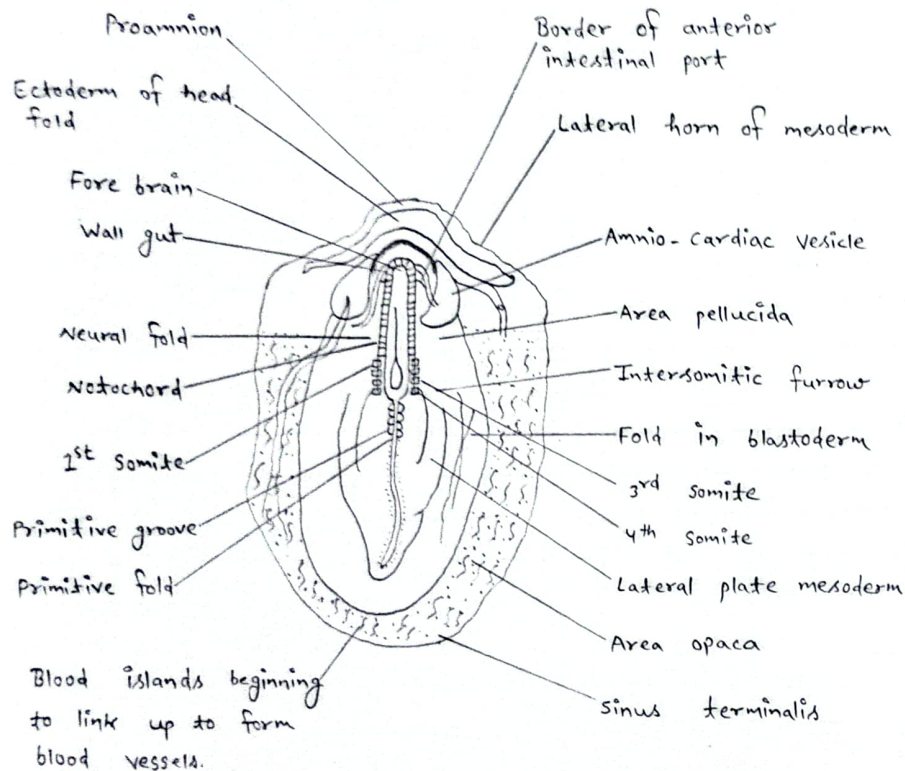
chick embryo: whole mount 18 hours of incubation

*psa*

1. Notochord has become markedly elongated to form a conspicuous structure.
2. Notochord extending towards the cephalic region in the middle from Hensen's node.
3. Embryo of 18 hours of incubation is often spoken of being in the "head process stage".
4. Neural plate develops around the notochord.
5. The dark peripheral area opaca, inner translucent area pellucid and central embryonal area is seen.
6. In the anterior region is present a small and more translucent portion of area pellucid which is known as praemion.
7. Praemion is characterized by the absence of mesoderm.
8. Primitive streak lies in the middle of the pellucid in the posterior half.
9. Neural plate and primitive streak are separated by Hensen's node.

Teacher's Sign





chick embryo: whole mount 24 hours of incubation

*psm*

chick embryo: 24 hours (whole mount)

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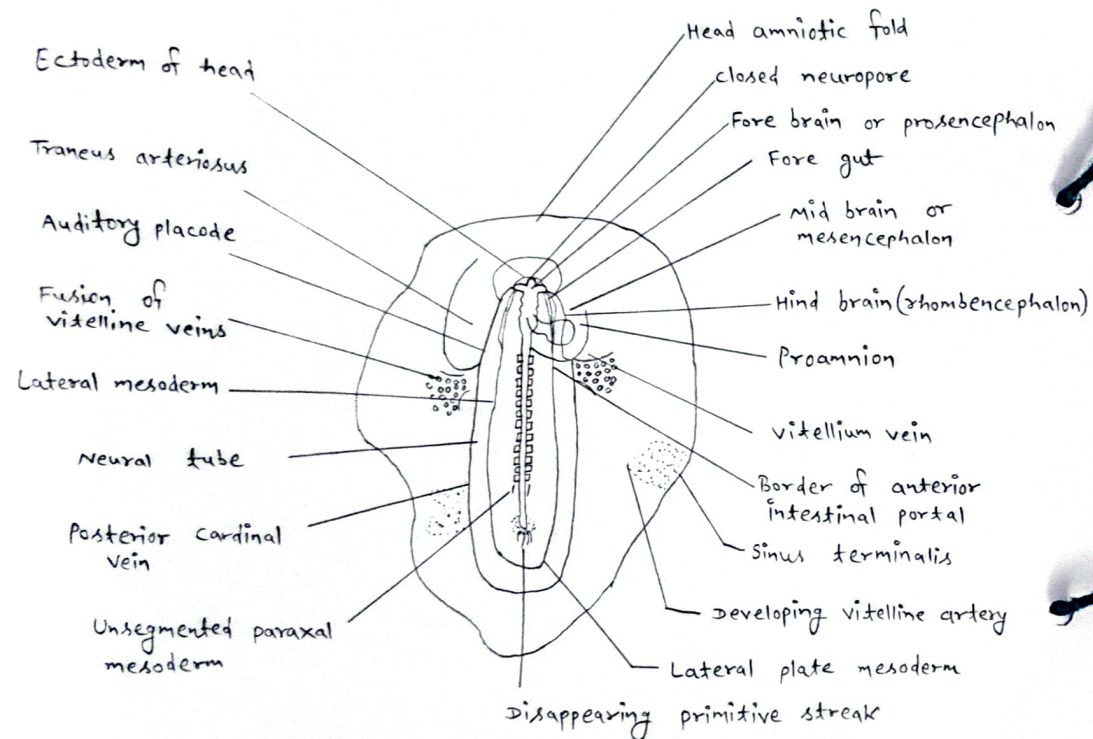
1. In 24 hours chick embryo cephalic region undergoes rapid growth. It extends anteriorly overhanging the proamnion region.
2. The cephalic region which projects free from the blastoderm may now properly be termed as the head of embryo.
3. The space formed between the head and the blastoderm is called the subcephalic pocket.
4. In the mid-line the notochord is seen. It is larger caudally near its point of origin than it is cephalically.
5. The neural plate is much more clearly marked.
6. The neural folds appear as a pair of dark bands.
7. At its cephalic end, the neural groove is deeper and the neural folds are correspondingly more prominent than they are caudally.
8. Four pairs of somites are seen in the mid-line.
9. Primitive streak gradually decreases in size.
10. Foregut is also formed. The part of the gut caudal to the foregut is termed the midgut and opening from the midgut into the foregut is called the anterior intestinal portal.
11. Besides the above structures, area opaca vitellina, area pellucid, proamnion, Hensen's node, area

Teacher's Sign

vasculosa, blood islands and unsegmented mesoderm  
are also seen.

Teacher's Sign .....





Chick embryo: whole mount 33 hours of incubation

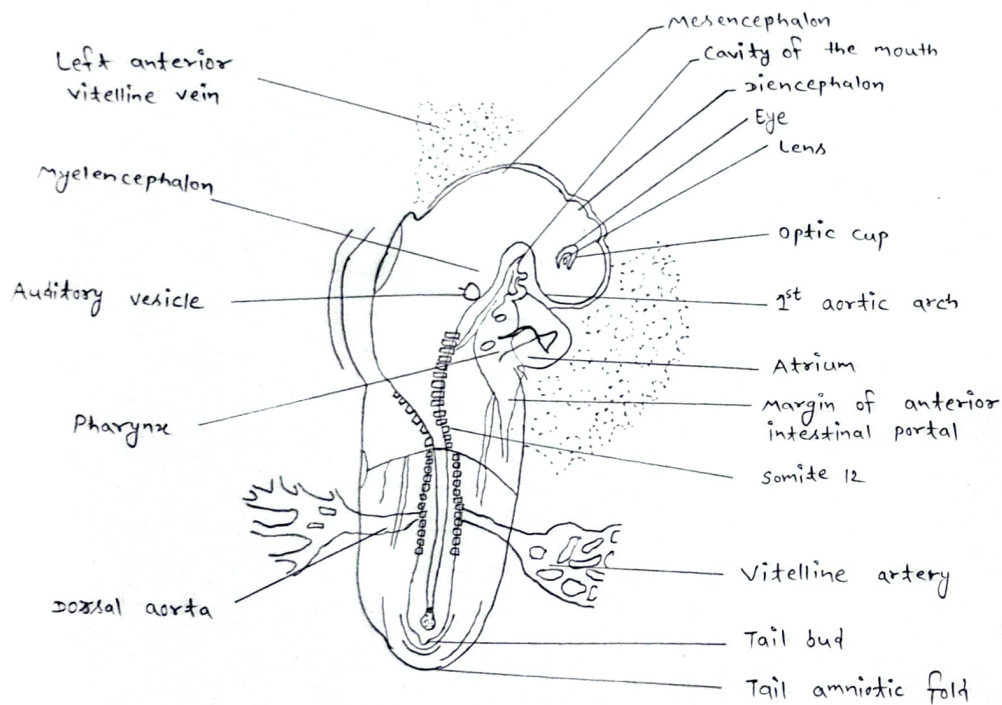
*ps*

## Chick embryo - 33 hours (whole mount)

Date     /    /      
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1. The embryo of 33 hours of incubation shows some of the fundamental steps in the formation of central nervous system and circulatory system.
2. Brain is differentiated into prosencephalon (fore-brain), mesencephalon (mid-brain) and rhombencephalon (hind-brain).
3. The optic vesicles are established as paired lateral outgrowths of the prosencephalon.
4. The optic vesicles soon extended to occupy the full width of the head.
5. Infundibulum is formed in the floor of prosencephalon.
6. Mid-region of the heart is considerably dilated and bent to the right.
7. Twelve pairs of somites are formed.
8. Anterior omphalomesenteric veins have developed.
9. Primitive streak becomes shorter because of the lengthening of the neural tube.
10. Proamnion, neural tube, notochord, sinus rhomboidalis and sinus terminalis are also present.

Teacher's Sign



chick embryo: 48 hours of incubation

*150*

## Chick embryo- 48 hours (Whole mount)

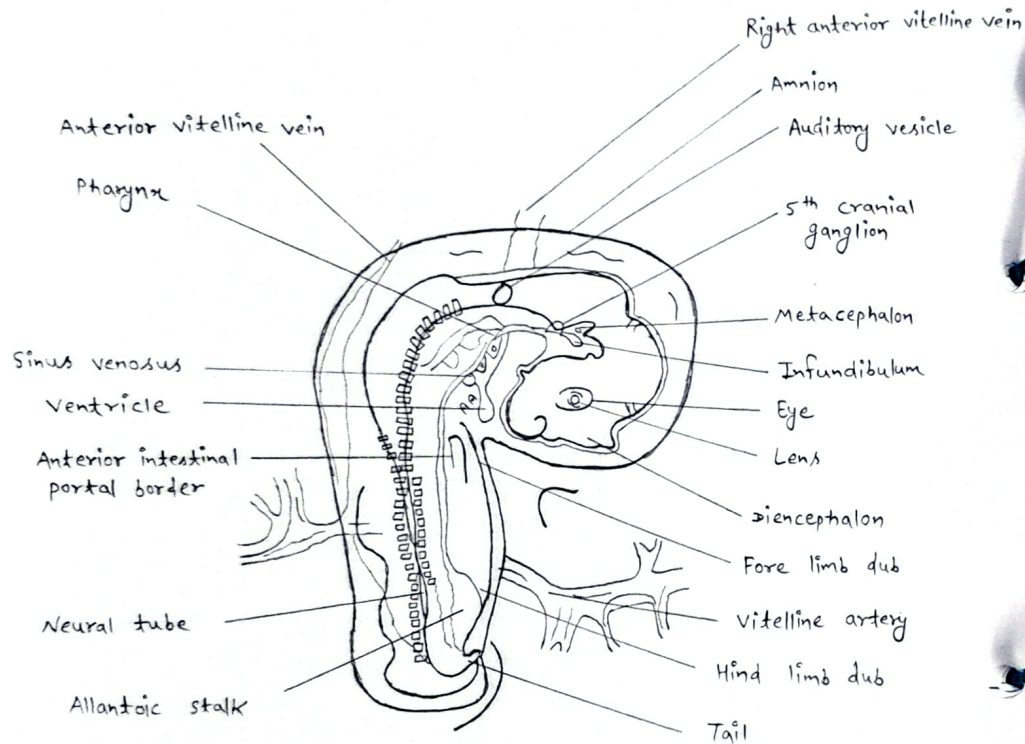
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1. The position of the embryo with respect to the yolk changes strongly about 48 hours after fertilization.
2. In addition to the head fold of the amnion, also the lateral and caudal amniotic folds begin to form.
3. The outgrowth of the cranial flexure is so strong that the forebrain and hindbrain vesicles become almost located to each other.
4. The cephalic region of the embryo is twisted in such a manner that the left side comes to lie next to the yolk.
5. A second flexure appears at the transition of the head and the body just behind the heart region.
6. The embryo takes now the shape of a 'C'.
7. The head becomes covered by a double fold. These folds definitely establish the first extra embryonic membrane (outside of the embryo): the amnion membrane.
8. The vitelline (yolk rich) arteries and veins become connected with the extra embryonic circulatory vessels. The brain divides into 5 vesicles: telencephalon and diencephalon (both formed by the division of the forebrain vesicle), mesencephalon, metencephalon and myelencephalon (both formed by the division of the hindbrain vesicle).

Teacher's Sign



9. The lens placode (placode-plate) will form the lens vesicle, the optic vesicle will become the optic cup and the auditory placode the auditory pit.
10. The heart differentiates into 4 compartments: the sinus venosus, connected with the veins, the atrium, the U-shaped ventricle and the bulbus cordis.
11. The atrium and ventricle are well distinguished in the figure.



Chick embryo: 72 hours of incubation

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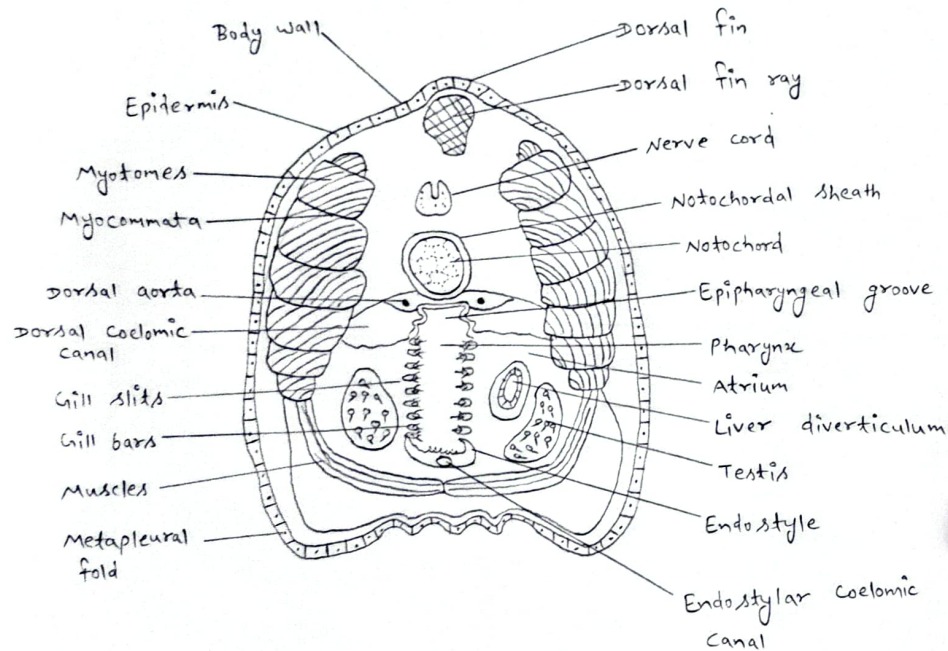
### Chick embryo-72 hours (Whole mount)

Date: / /  
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1. The chick embryo of 72 hours of incubation has been affected by torsion throughout its entire length.
2. The torsion is complete well posterior to the level of heart but the caudal portion of the embryo is not turned on its side.
3. Due to the cranial and cervical flexures, the long axis of the embryo shows nearly right angled bends in the mid-brain and in the neck region.
4. The mid-body region is slightly concave dorsally because of the fact that the embryo is still attached to yolk in this region.
5. The visceral arches are thicker and more conspicuous than in the anterior embryo.
6. Both the anterior and posterior appendage buds have appeared in the embryo.
7. Telencephalon is also formed.
8. In the eye, lens, sensory and pigment layers are developed.
9. The number of somites increases to 26 pairs.
10. Vitelline arteries and vitelline veins are also well developed.
11. Nasal pits appear as shallow depressions in the ectoderm of the rostral part of the head which overhangs the mouth region.

Teacher's Sign: \_\_\_\_\_





Amphioxus: T.S. passing through testes

## Amphioxus: T.S. passing through testes

Date     /    /      
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T.S. of Amphioxus through testes reveals the following structure:-

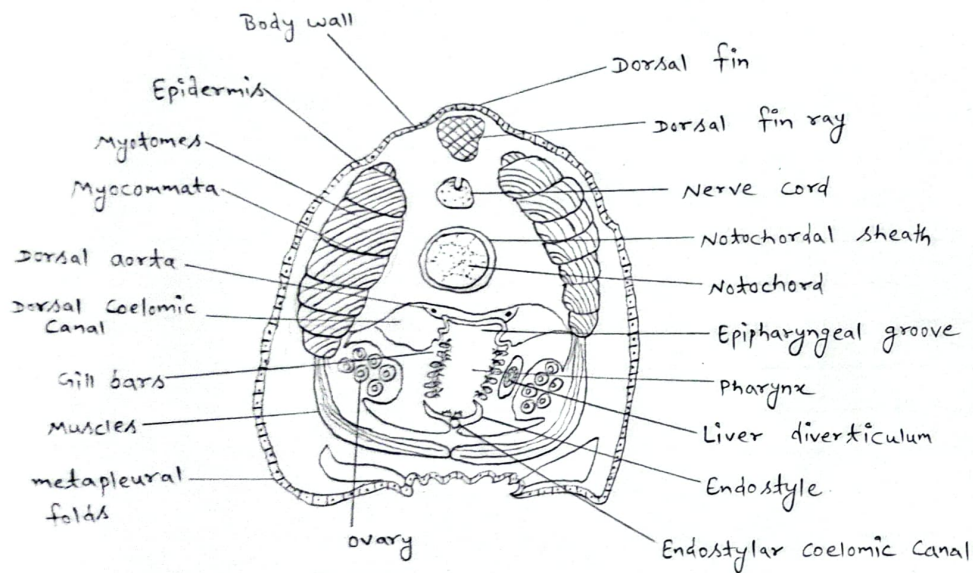
1. Body wall is composed of single layer of simple columnar epithelium.
2. Dorsal fin having the dorsal fin ray is present on the dorsal surface.
3. Myotomes separated by myocommata are present on both the sides.
4. Nerve cord contains a central canal and lies below the dorsal fin ray.
5. Notochord composed of vacuolated cells and surrounded by notochordal sheath, lies below the nerve cord.
6. Pharynx is quite ~~am~~ spacious occupying the most of the space between the notochord and the metapleural folds.
7. The pharynx is perforated by numerous gill slits.
8. In the mid-dorsal line of pharynx lies a ciliated epipharyngeal-groove, while in the mid-ventral line is present a glandular ciliated endostyle.
9. Two dorsal aortae are present, one on either side of the epipharyngeal groove.
10. The atrium is present around the pharynx.
11. The coelom appears as dorsal coelomic canals on either side of the epipharyngeal groove.

Teacher's Sign

Parts of coelom are also present in the endostyle, in the metapleural folds and around the liver diverticulum and gonads.

12. The testes, one pair in the section, lie in the atrium on both the sides of the pharynx.
13. The testes contains several spermatozoa.
14. Two metapleural folds are present on both the sides.





Amphioxus: T.S. passing through ovary

### Amphioxus: T.S. passing through ovary

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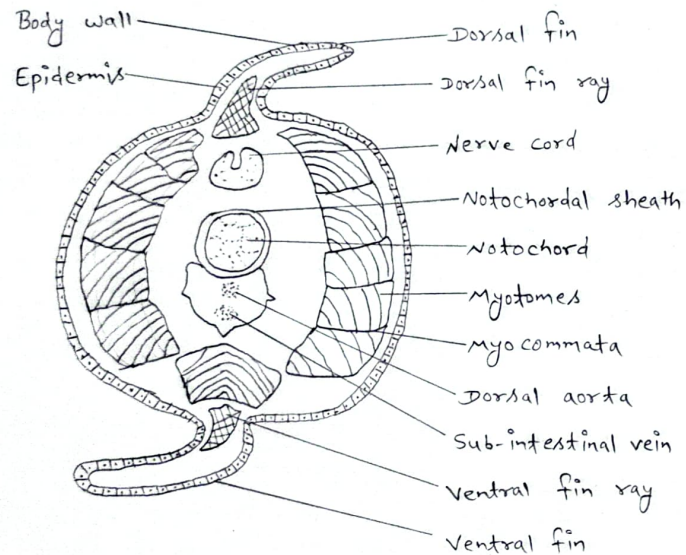
T.S. of Amphioxus through the ovaries reveals the following structure:-

1. Body wall is formed of epidermis which is composed of single layer of simple columnar epithelium.
2. Dorsal fin having the dorsal fin ray is present on the dorsal surface.
3. Myotomes separated by myocommata are present on both the sides.
4. Nerve cord contains a central canal and lies below the dorsal fin ray.
5. Notochord composed of vacuolated cells and surrounded by notochordal sheath, lies below the nerve cord.
6. Pharynx is quite spacious occupying the most of the space between the notochord and the metapleural folds.
7. Two dorsal aortae are present, one on either side of the epipharyngeal groove.
8. The coelom appears as dorsal coelomic canals on either side of the epipharyngeal groove. Parts of coelom are also present in the endostyle, in the metapleural folds and around the liver diverticulum and gonads.
9. The ovaries are the same as in the previous section.
10. The ovaries contain several ova.

Teacher's Sign

11. Two metapleural folds are present on both the sides.





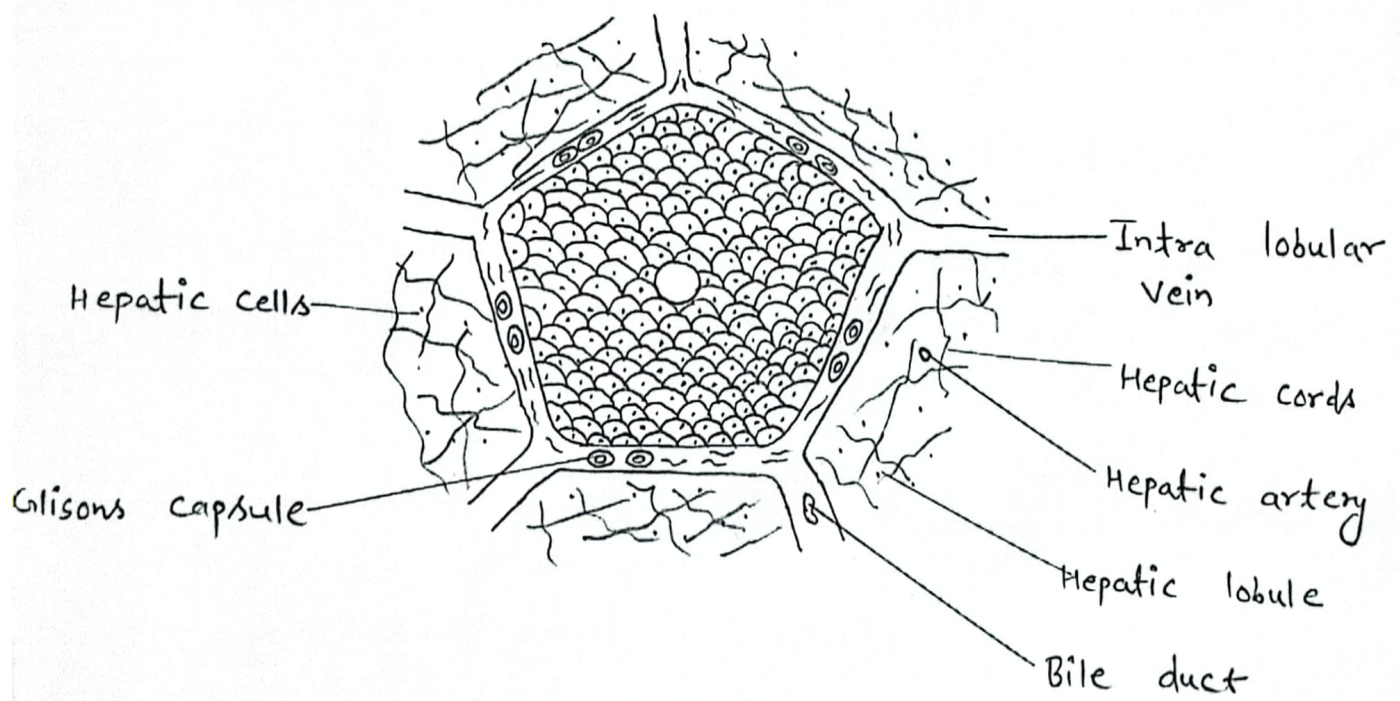
Amphioxus: T.S. passing through caudal region

Amphioxus: T.S. passing through caudal region Date     /    /      
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T.S. of Amphioxus passing through the caudal region shows the following structures:-

1. Body wall comprises single layer of epidermis which is composed of simple columnar epithelium.
2. Dorsal and ventral fins containing the respective fin rays are also present.
3. Myotomes separated by myocommata are present on both the sides.
4. Dorsal tubular nerve cord lies below the dorsal fin ray.
5. Notochord is surrounded by notochordal sheath and composed of vacuolated cells. It occupies the central portion of the section.
6. Dorsal aorta and sub intestinal vein lie below the notochord, the dorsal aorta is dorsal to the vein.
7. The intestine, coelom and atrium are wanting.
8. Metapleural folds are also absent.

Teacher's Sign



T.S. passing through liver (Mammal)

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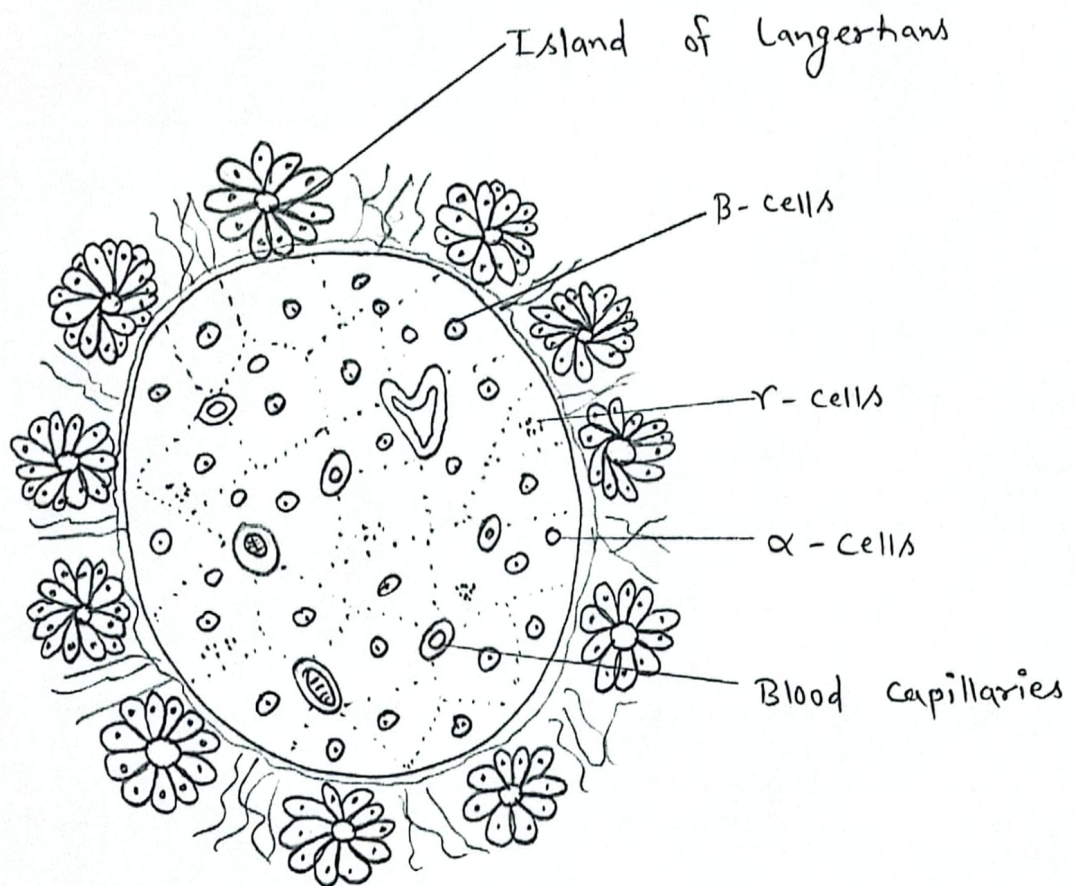
## T.S. passing through liver (Mammal)

Date	__/__/__
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T.S. of liver of a mammal shows the following histological structures:-

1. The liver is composed of polygonal lobules containing a central vein (intra-lobular vein) in the centre and portal canals at the corners.
2. Each portal canal consists of connective tissue strand and contains a branch of portal (inter-lobular vein), hepatic artery, bile duct and lymph vessel.
3. The liver cells are polyhedral or rectangular and arranged in single celled long chains extending radially from the central vein to the periphery of the lobule.
4. Each liver cell has granular cytoplasm and a prominent nucleus.
5. The sinusoid are formed from branched of the hepatic portal veins and empty into central veins.
6. Liver has several functions which are as follows:-
  - (i) It produces bile which plays an important role in the digestion of food.
  - (ii) It stores the soluble products of digestion and metabolizes them for assimilation.
  - (iii) Oxidation of sugar takes place in it.
  - (iv) Toxic substances are detoxicated in the the liver.

Teacher's Sign .....



T.S. passing through Pancreas (mammal)

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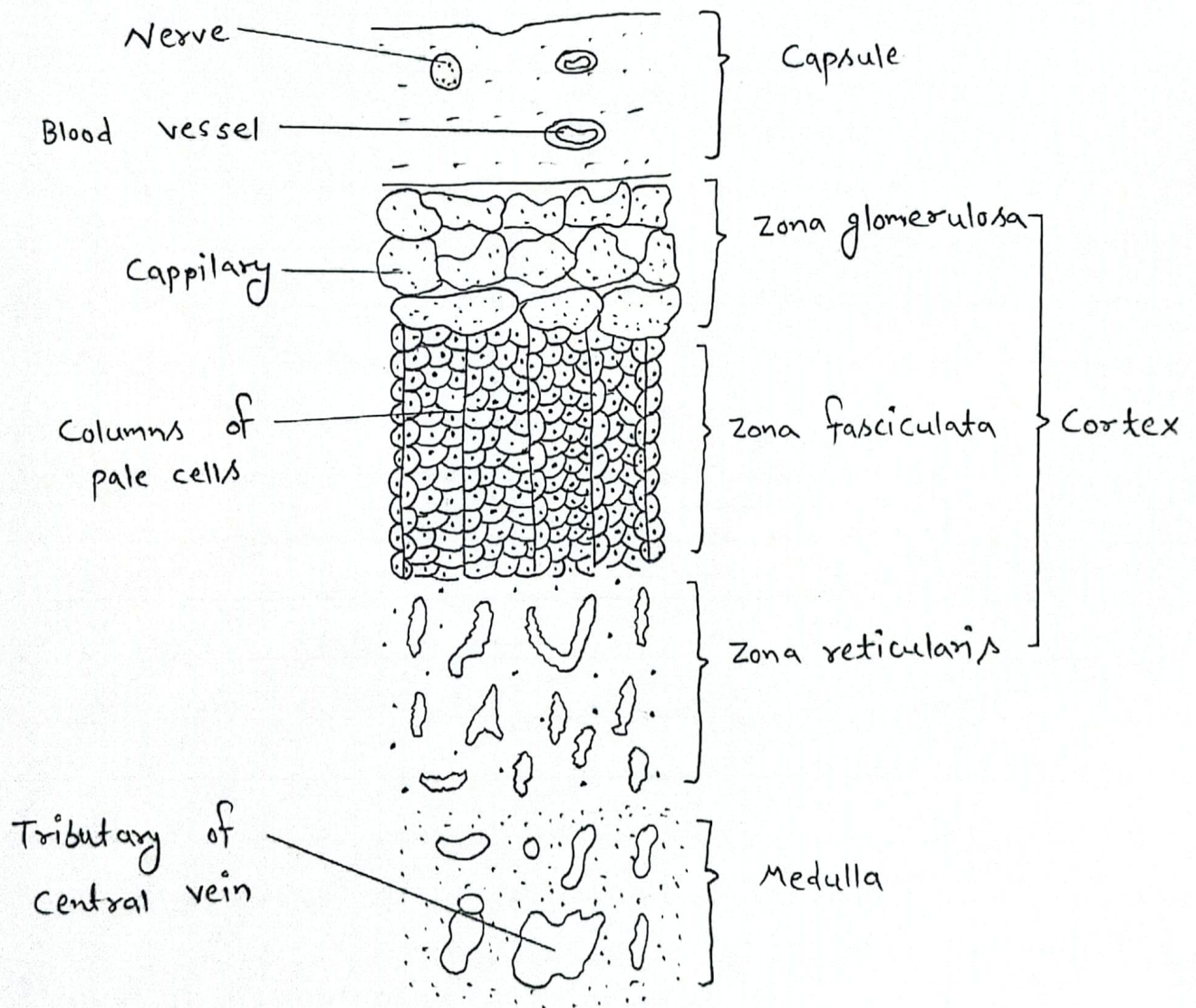
## T.S. passing through pancreas (Mammal)

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T.S. of pancreas of a mammal shows the following histological details:-

1. The pancreas consists of two portions namely, exocrine portion and endocrine portion.
2. The exocrine portion consists of a series of lobules or acini.
3. The lobules or acini are bound together by loose connective tissue containing blood vessels, nerve and lymph vessels.
4. Each lobules or acini are bound together by loose connective tissue. Acini is made up of few pyramidal pancreatic cells having granular cytoplasm and prominent nuclei.
5. The lobules or acini open into small ductules which join large ducts and eventually the main pancreatic ducts.
6. The exocrine portion produces pancreatic juice which contains trypsin, amylase and lipase enzymes.

Teacher's Sign .....



T.S. passing through Adrenal gland (mammal)

*[Handwritten signature]*



## T.S. passing through adrenal gland (Mammal)

Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
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T.S. of adrenal gland of a mammal shows the following histological structures:-

1. The adrenal gland is composed of two distinct parts, i.e., outer cortex and inner medulla surrounded by the capsule.
2. The capsule is composed of fibrous connective tissue containing blood vessels and nerves.
3. The cortex lies next to the capsule and is differentiated into 3 zones namely - Zona glomerulosa, Zona fasciculata and Zona reticularis.
  - (i) Zona glomerulosa is made up of columnar cells containing large nuclei. The cells are arranged in oval groups which resemble either closed or open vesicles.
  - (ii) Zona fasciculata consists of columns of large rounded cells containing nuclei. The cells are arranged radially in double rows.
  - (iii) Zona reticularis consists of networks of columnar cells containing pigment granules. Numerous blood sinusoids are found in the networks.
4. The cortex produces a hormone known as cortin. It regulates the general metabolism, controls the sodium chloride content of the blood and also promotes the breaking down of the tissue proteins to amino acids.
5. Medulla is the central portion, consists of networks or cords of polygonal cells and

Teacher's Sign .....

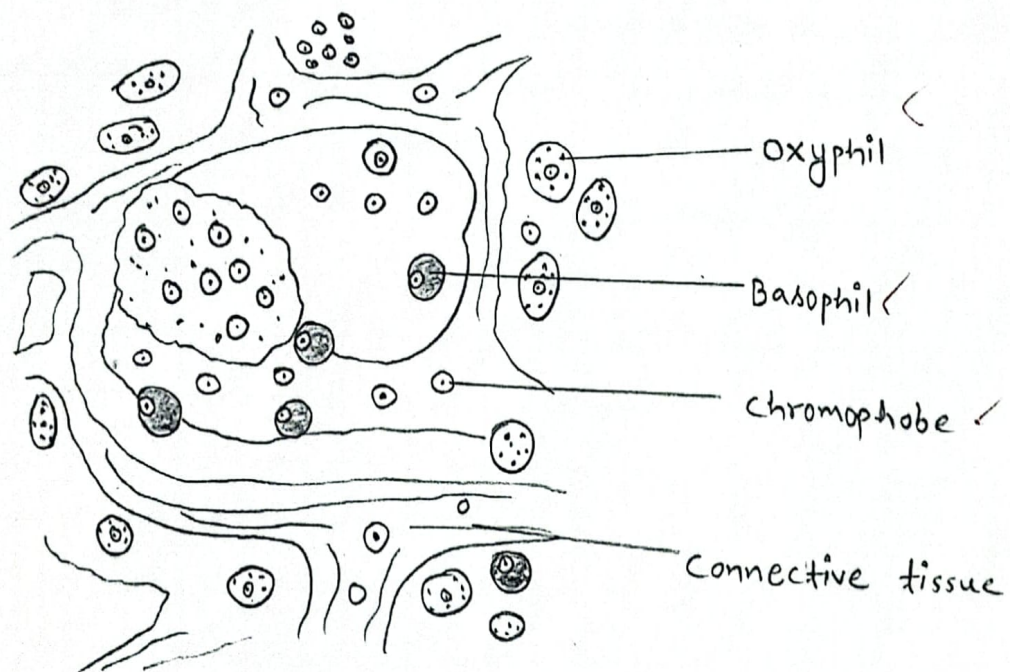


clusters of chromatin cells, networks of cells contain numerous blood capillaries, sinusoids and in the centre of a central vein.

6. Medulla secretes a hormone known as adrenalin. It is responsible for maintaining the blood pressure, dilation of vessels and muscles, increasing the general metabolism rate and also hastening the coagulation of blood.

7. The adrenal glands are endocrine glands and lie just above the kidney attached to it by a fold of mesentery.





V.L.S. passing through anterior lobe of pituitary gland (mammal)

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8/10/20



V.L.S. passing through anterior lobe of pituitary gland (Mammal)

Date \_\_\_\_\_  
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V.L.S. of anterior lobe of pituitary gland of a mammal shows the following histological structures:-

1. The pituitary gland is more or less glandular in shape and occurs at the base of brain in the region of diencephalon.
2. It is composed of three lobes namely, anterior lobe, intermediate lobe and posterior lobe.
3. The anterior lobe forms the largest part of pituitary gland.
4. It is formed of three distinct kinds of cells differing in their staining reactions.
5. Usually on the outside are basophil cells which are stained by basic stains.
6. In the centre are found acidophil or oxyphil cells which take stain with acid stains.
7. The third type of cells is chromophobe cells which are indifferent to either basic or acid stains. They are found scattered throughout the anterior lobe.
8. The anterior lobe produces many hormones namely somatotrophic hormone, adrenocorticotrophic hormone, gonadotrophic hormone and thus controls growth, development of sex glands as well as the activities of thyroid, adrenal and parathyroid glands.
9. The intermediate lobe is composed of cell cords

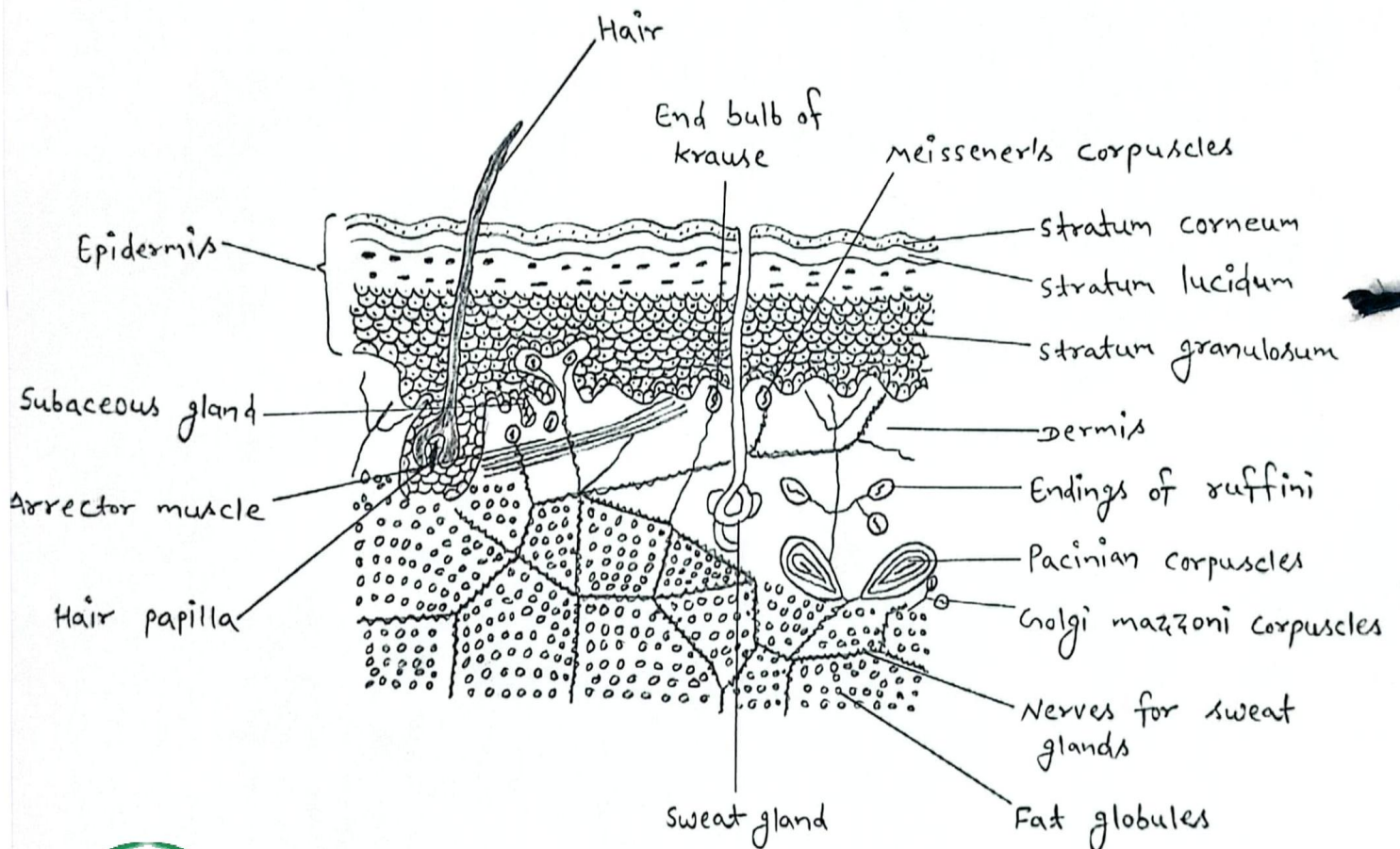
Teacher's Sign .....



with colloid filled follicles. It produces an intermedin hormone.

10. The posterior lobe is composed of neurological cells, connective tissue fibres and blood vessels. It produces pituitrin, vasopressin and oxytocin hormones.

11. The pituitary gland is an endocrine gland of utmost importance to organisms.



V.S. of skin of mammal



## V.S. of skin of a mammal

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V.S. of skin of a mammal shows the following histological structures:-

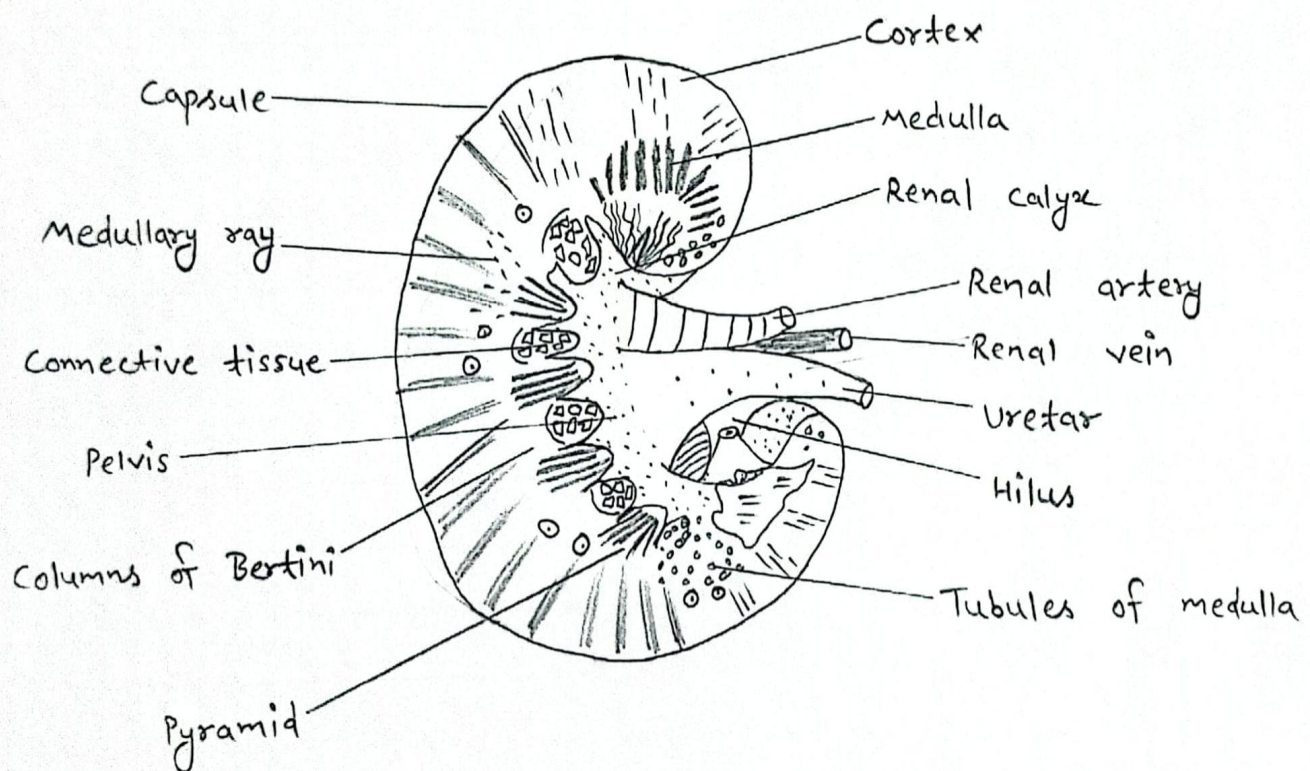
1. The skin is composed of two layers, i.e., an outer layer epidermis and an inner layer dermis.
2. The epidermis comprises of four layers namely outer stratum corneum, next to it stratum lucidum then stratum granulosum and innermost layer is stratum germinativum.
3. Stratum corneum consists of horny cells and periodically moulted.
4. Stratum granulosum is made up of granular cells.
5. The dermis consists of dense areolar connective tissue, muscle fibres, blood vessels, nerves and glands.
6. The mammalian skin is characterized by the presence of hairs and glands.
7. The hair root is lodged in the hair follicle and hair follicle swells up at the base forming the hair bulb.
8. Blood vessels, nerves and connective tissue from the dermis project into the hair bulb forming the hair papilla.
9. Some unstriated muscle fibres connect the hair with the epidermis. These muscle fibres ~~were~~ move the hair involuntarily and are known as arrector muscles of the hair.

Teacher's Sign .....



10. The glands are of two types namely sebaceous glands and sweat glands.
11. The sebaceous glands are small glands of the simple branched alveolar type. Usually each gland is connected to a hair and opens by a short duct close to it.
12. The sweat glands are coiled, tubular and much longer. Each gland opens on the surface through a long coil duct.
13. The main function of sweat glands is temperature regulation of body.





L.S. passing through kidney of a mammal





## L.S. passing through kidney of a mammal

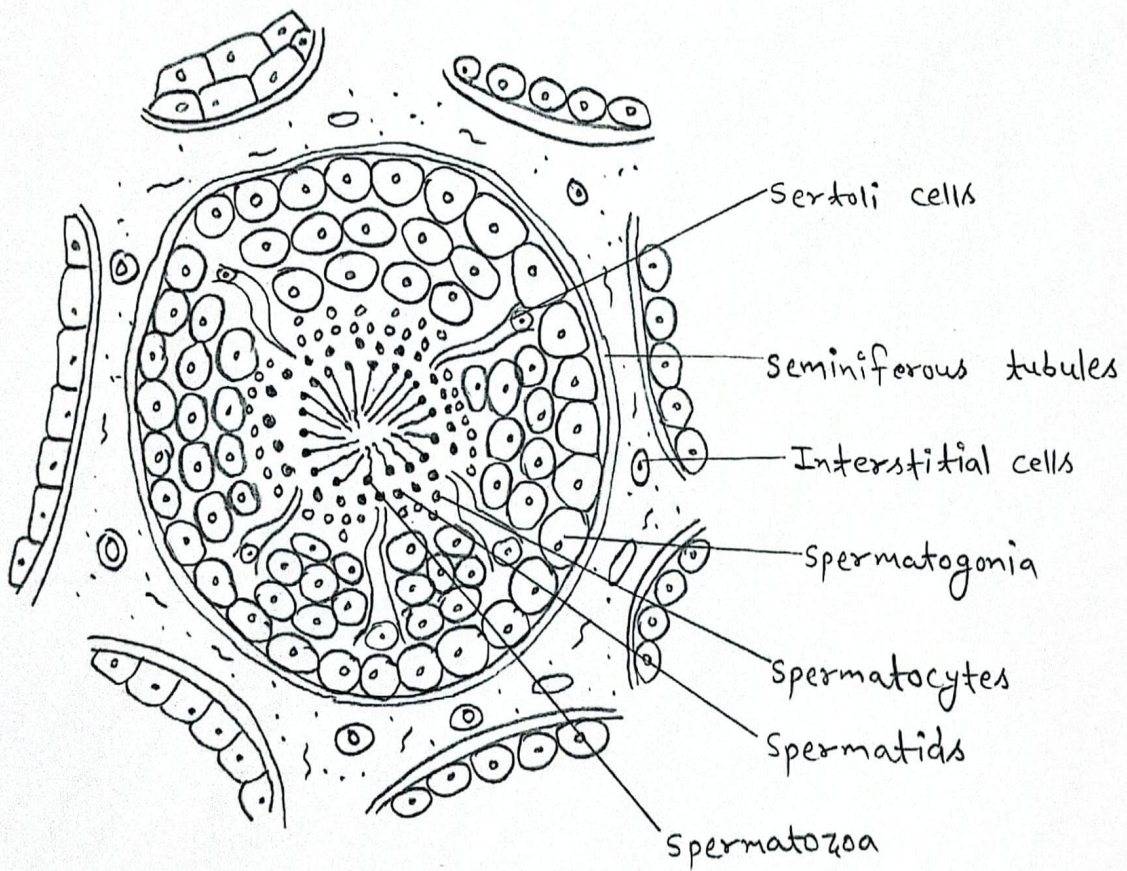
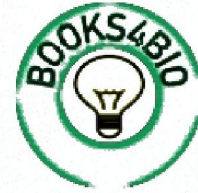
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L.S. of kidney of a mammal shows the following histological details:-

1. The kidney is surrounded by a capsule of dense connective tissue.
2. The glandular part of the kidney composed of outer cortex and inner medulla.
3. The cortex contains numerous uriniferous tubules, malpighian capsules having Bowman's capsules and glomerulus scattered throughout.
4. The medulla is composed of several renal pyramids, medullary rays, columns of Bertini, tubules of medulla and connective tissue.
5. The depression found in the middle of the inner concave region is known as hilus.
6. A slender muscular tube known as ureter takes its origin at the hilus and runs backwards to join the urinary bladder.
7. The renal artery and renal vein are in and out of the hilus.
8. The renal pelvis comprises uriniferous tubules which include the proximal portion of ureter, major renal calyces (branches of ureters towards the renal portion) and minor renal calyces (branches of the major calyces).

Teacher's Sign .....





T.S. passing through Testis of a mammal



## T.S. passing through Testis of a mammal

Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
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T.S. of testis of a mammal shows the following details:-

1. The testis is somewhat rounded or oval in shape and surrounded by peritoneum followed by a layer of fibrous connective tissue, the tunica albuginea.
2. Histologically each testis is composed of a mass of coiled seminiferous tubules.
3. The seminiferous tubules are separated from one another by intertubular tissue.
4. The intertubular tissue is formed of connective tissue which holds the tubules together and contains blood vessels and interstitial cells.
5. The interstitial cells secrete a hormone testosterone, responsible for male secondary sexual characters.
6. Each seminiferous tubule appears rounded or oval in section surrounded by basement membrane and lined by germinal epithelium.
7. In between the germinal cells certain larger cells called Sertoli cells are usually seen. These cells have the role of supplying nourishment to the developing sperms.
8. The germinal epithelium gives rise to sperms which are seen in various stages of development in a seminiferous tubule as follows:-
  - (i) The spermatogonia lie along the periphery



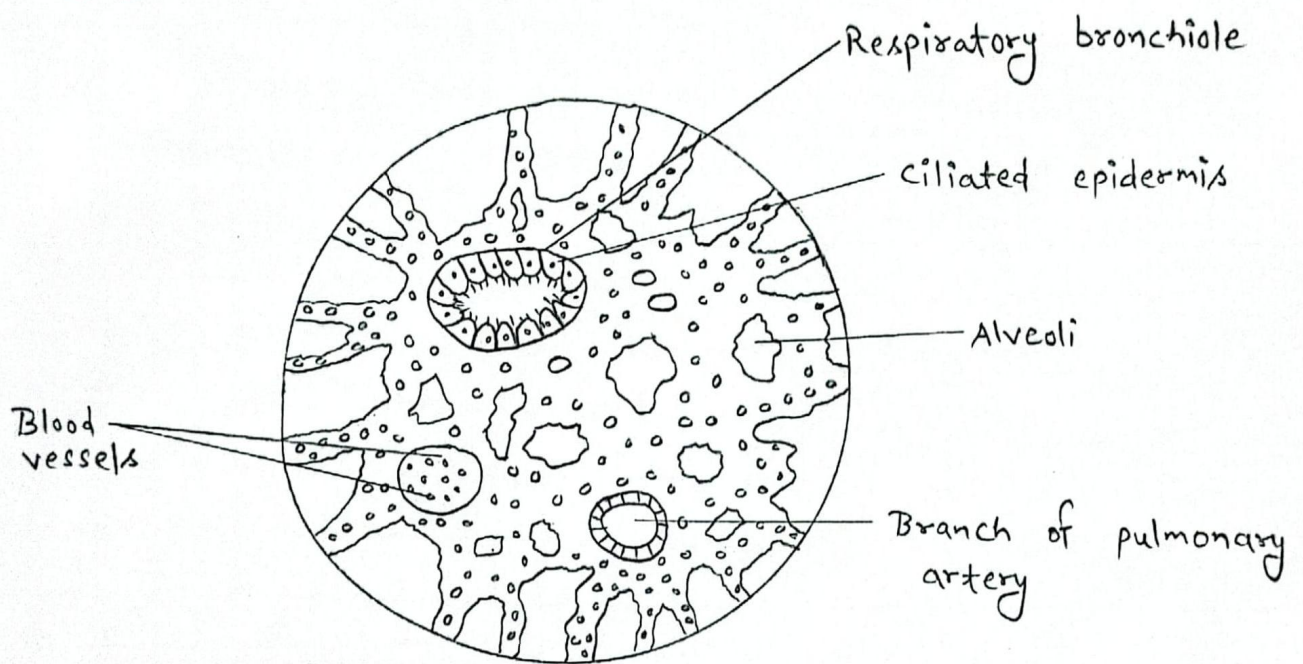
of the tubule and appear closely packed together.

(ii) The spermatocytes lie just below the spermatogonia which develops into primary and secondary spermatocytes.

(iii) The spermatids aggregate in clusters below the spermatocytes.

(iv) The spermatozoa lie in the cavity of the tubule, grouped in clusters and appear connected with Sertoli cells.

3. A spermatozoon or sperm has an elongated head and long delicate tail. Its nucleus lies in the head.



T.S. passing through lung of a mammal



## T.S. passing through lung of a mammal

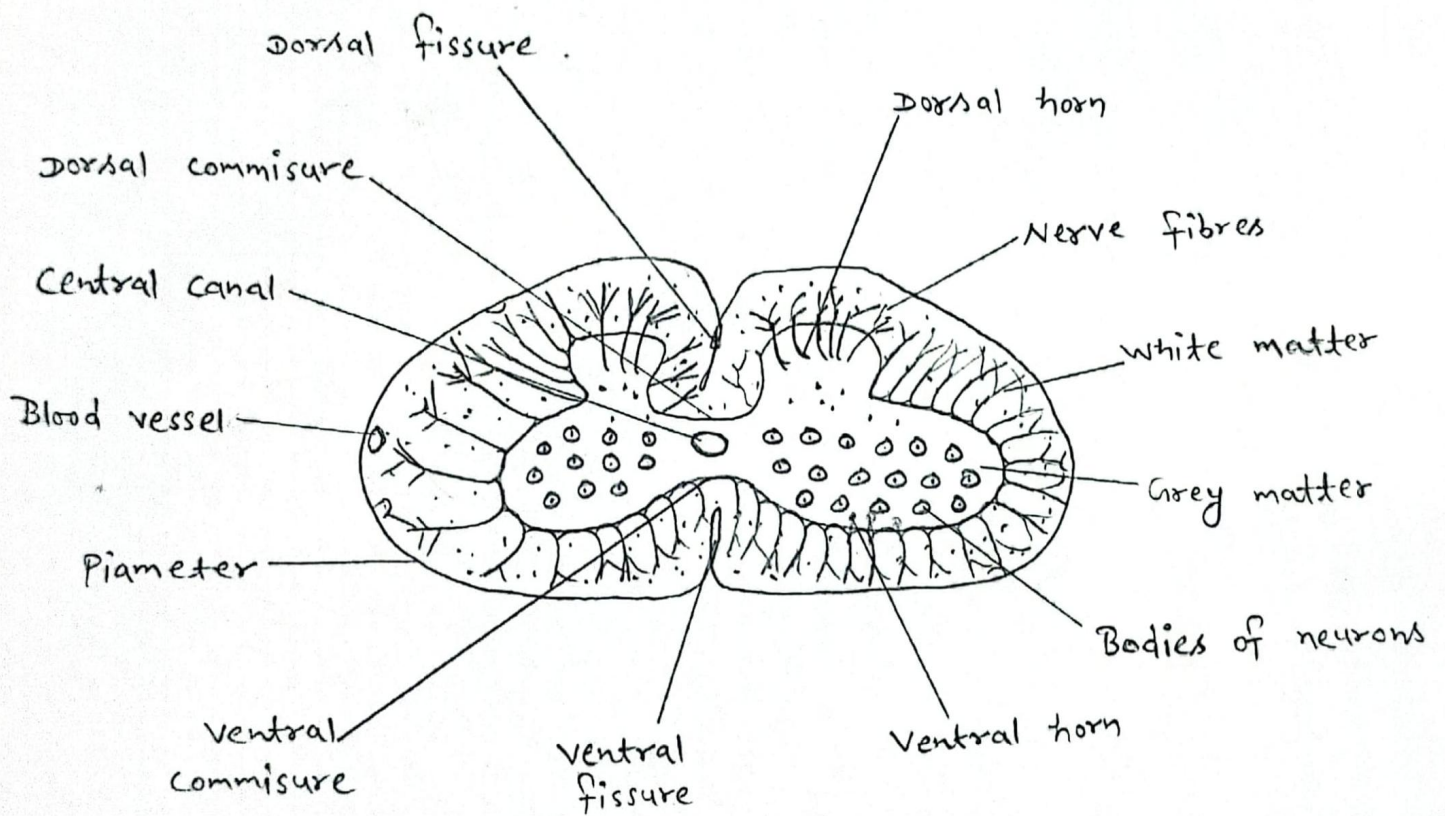
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T.S. of lung of a mammal shows the following structures:-

1. Histologically it consists of numerous alveoli.
2. The alveoli communicate with one another by a pertures in their walls.
3. Around each alveolus is a network of capillary blood vessels in connection with pulmonary artery or vein of the lung.
4. Numerous alveoli form clusters which open in a alveolar duct.
5. Each bronchus enters the lungs, divides and sub-divides into the finer and finer branches, the bronchioles.
6. The bronchioles are subdivided into respiratory bronchioles.
7. The respiratory bronchiole gives rise to several alveolar ducts which open into alveoli or air-sac.
8. The alveoli which are richly supplied with blood vessels form the seat of respiration.
9. The air is taken into the alveoli by the respiratory bronchioles through alveolar ducts which get it from bronchioles which in their turn get it from the bronchus.

Air  $\rightarrow$  trachea  $\rightarrow$  bronchus  $\rightarrow$  bronchioles  $\rightarrow$  respiratory bronchioles  $\rightarrow$  alveolar ducts  $\rightarrow$  alveoli  $\rightarrow$  gaseous exchange takes place and  $\text{CO}_2$  is taken out.

Teacher's Sign .....



T.S. passing through Spinal Cord





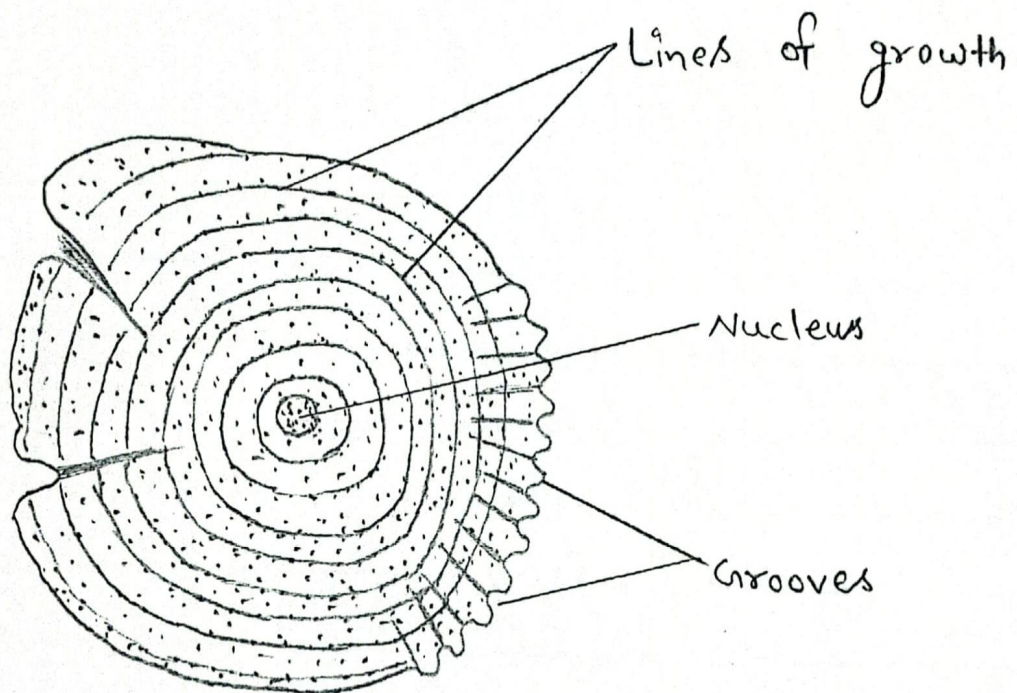
T.S. passing through spinal cord of a mammal

Page \_\_\_\_\_

T.S. passing through spinal cord shows the following structures:-

1. The thin layer of pia mater surrounds the spinal cord.
2. In the mid-dorsal surface is a dorsal fissure or septum and in the mid-ventral surface is a ventral fissure which is slightly wider.
3. In the centre there is a small cavity known as central canal. It is lined by simple epithelial cells.
4. The substance of the cord is differentiated into two zones i.e., the central zone called grey matter and a peripheral zone called the white matter.
5. The grey matter is H-shaped projecting dorsally into two dorsal horns and ventrally into two ventral horns.
6. The grey matter shows the presence of bodies of neurons with tree-like branching of their dendrons and neurological cells.
7. The white matter is composed of obliquely running medullated nerve fibres supported by prolongations of the neuroglia.
8. The bands of fibres which extend transversely, one dorsal and other ventral to the central canal, are known as dorsal and ventral commissars respectively.

Teacher's Sign .....



Cycloid scale (whole mount)

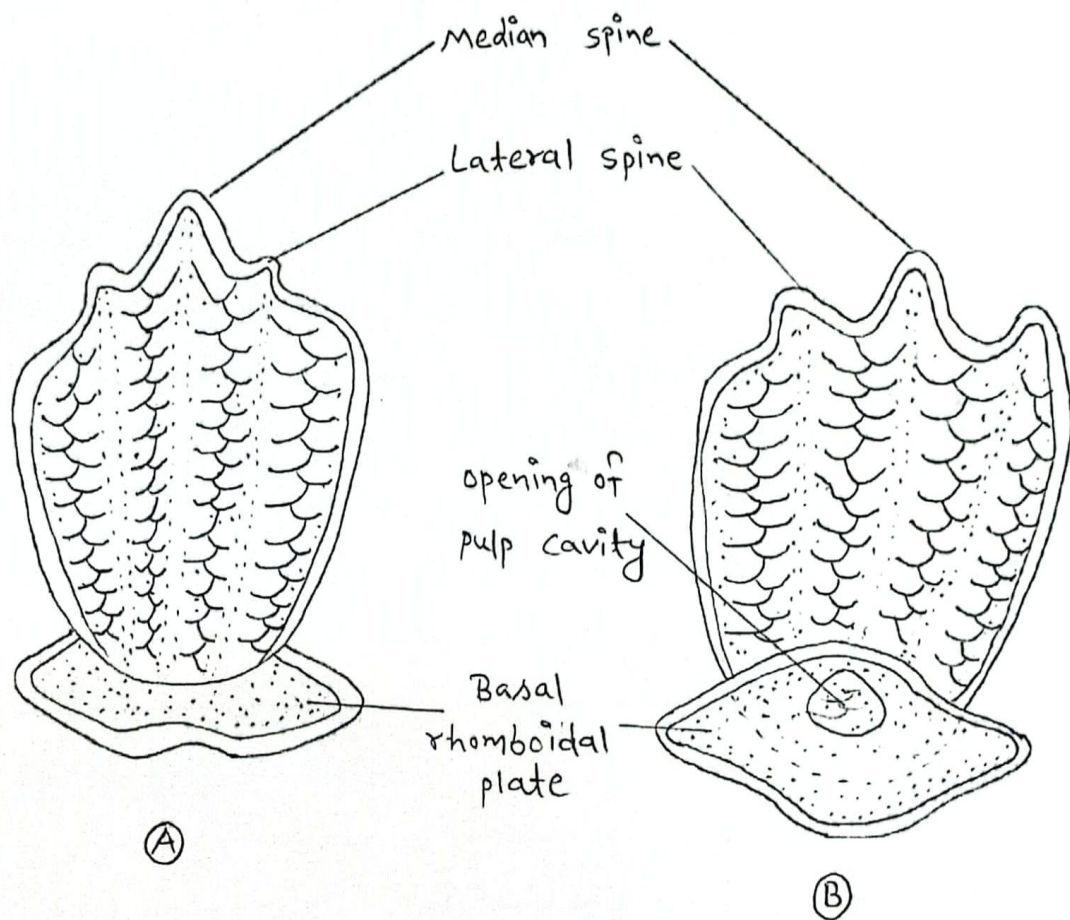


## Cycloid scale (whole mount)

Date \_\_\_\_/\_\_\_\_/\_\_\_\_  
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1. Cycloid scales are found in teleosts and dipnoi.
2. These are soft and dermal plates.
3. Each cycloid scale is roughly circular and flattened.
4. Each scale is composed of a central nucleus and numerous lines of growth.
5. The free or anterior border is more or less rounded and remains exposed.
6. The posterior part of the scale is having numerous longitudinal grooves for sucking the nourishment from the skin.
7. Pulp cavity and dentine are entirely absent.
8. Cycloid scales are derivatives of the ganoid scales in which ganoin and cosmine layer and bone cells are lost.

Teacher's Sign .....



Placoid scale: A. dorsal view B. ventral view

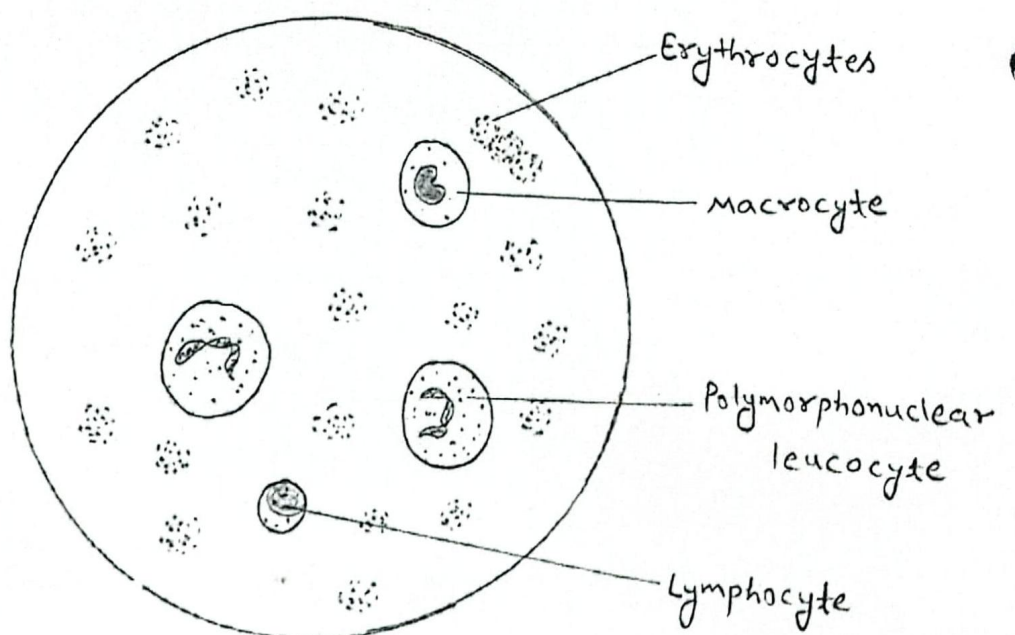


## Placoid scale (whole mount).

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1. The placoid scales are arranged in regular oblique rows, covering the entire surface of the body and form the exoskeleton of the shark.
2. Placoid scales are small pointed and tri-radiate denticles found embedded in the dermal layer of the skin.
3. A typical placoid scale consists of a diamond shaped or rhomboidal basal plate having an opening of the pulp cavity and flat trident spine.
4. The basal plate is formed of a trabecular calcified tissue, the cement.
5. The spine is composed of a hard calcareous substance, the dentine which is coated externally with hard and dense enamel.
6. The pulp cavity contains the vascular connective tissue, pulp containing numerous odontoblasts, blood vessels, nerves and lymph chamber.



Blood Smear (Mammal)



## Blood Smear (Mammal)

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The thin film of mammalian blood on slide shows the following structures:-

1. It shows numerous blood corpuscles of different shapes and size suspended in the plasma.
2. The erythrocytes (R.B.C.) are round, non-nucleated and biconvex blood cells plays role in oxygen transportation.
3. The leucocytes (W.B.C.) are colourless, nucleated and shows amoeboid movement. Three types of leucocytes are seen in blood smear:-
  - (i) Polymorphonuclear leucocyte: The nucleus of this type of leucocytes is divided into a number of segments (3-5) connected with one another by fine thread. The cytoplasm of this type of cells is granular.
  - (ii) Macrocytes are largest leucocytes and possess a horse-shoe-shaped nucleus. The cytoplasm of these cells is without granules.
  - (iii) Lymphocytes are small with large nucleus and little cytoplasm.
4. The number of erythrocytes in normal adult man and woman is about 4.5 million or 5.0 million /  $\text{mm}^3$  of blood.





Gram +ve Bacteria (Lactobacillus)



## Identification of gram +ve and -ve bacteria

Page: \_\_\_\_\_

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\* Aim:- To study the identification of gram +ve and gram -ve bacteria.

\* Principle:- When the bacteria is stained with primary stain crystal violet and fixed by the mordant, some of the bacteria are able to retain the primary stain and some are decolorized by alcohol. The cell walls of gram +ve bacteria have a thick layer of peptidoglycan and lipid content is low. Decolorizing the cell causes this thick wall to dehydrate and shrink, which closes the pores in the cell wall and prevents the stain from exiting the cell. So the ethanol cannot remove the crystal violet-Iodine complex that is bound to the thick layer of peptidoglycan of gram positive bacteria and appears blue or purple in colour.

In case of gram negative bacteria, cell wall also takes up the cv-Iodine complex but due to the thin layer of peptidoglycan and thick outer layer which is formed of lipids, cv-Iodine complex gets washed off. When they are exposed to alcohol, decolourizer dissolves the lipids in the cell walls, which allows the crystal violet-iodine complex to leach out of the cells. Then when again stained with safranin, they take the stain and appears red in colour.

\* Apparatus, Glassware & chemicals:- Bacterial culture, crystal

violet, Iodine, acetone and alcohol (95%), Safranin, Inoculation loop, slide and sterile water.

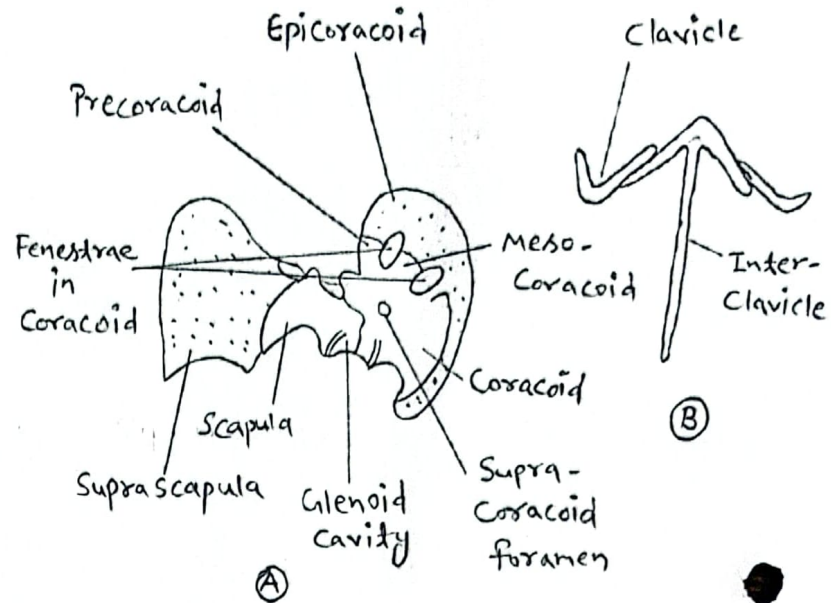
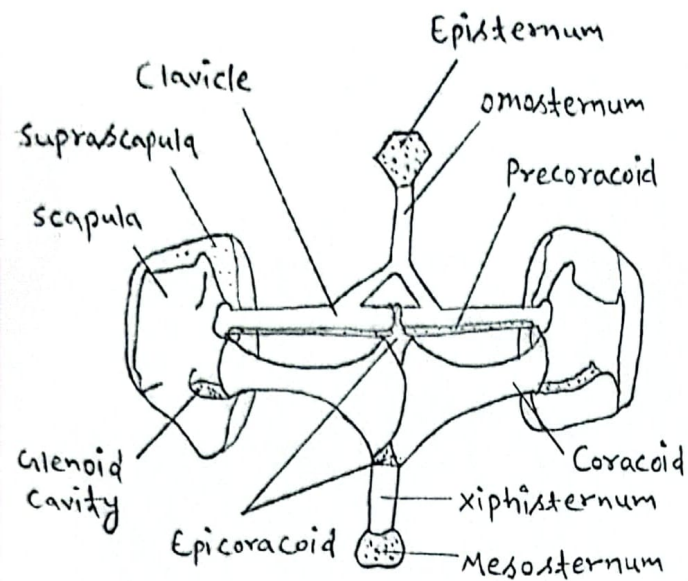
\* Procedure:-

1. We take a clean, grease free slide.
2. Prepare the smear of curd on the clean slide.
3. Air dry and heat fix the sample.
4. Crystal violet was poured and kept for about 30 seconds to 1 minutes and rinse with water.
5. Flood the gram's iodine for 1 minute and rinse with water.
6. Then, wash with 95% alcohol (acetone) for about 10-20 seconds and rinse with water.
7. We add safranin for about 1 minute and wash with water.
8. Air dry, Blot dry and observe under microscope.

\* Observation:- Purple stain, hence lactobacillus is a gram +ve bacteria.

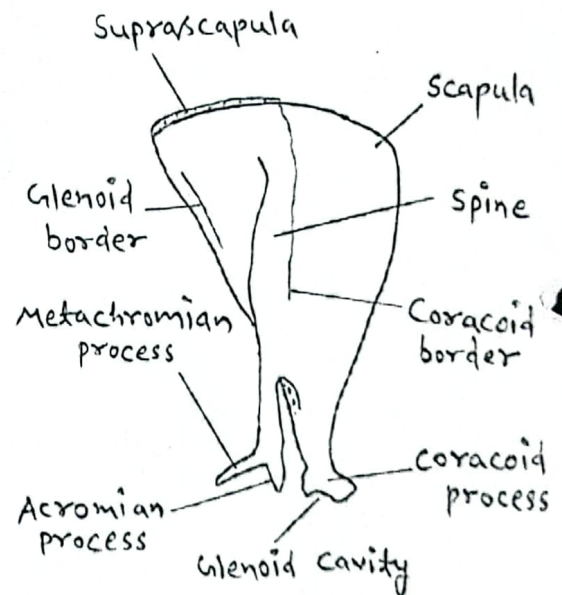
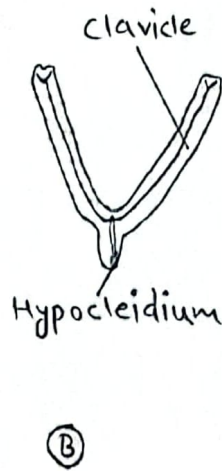
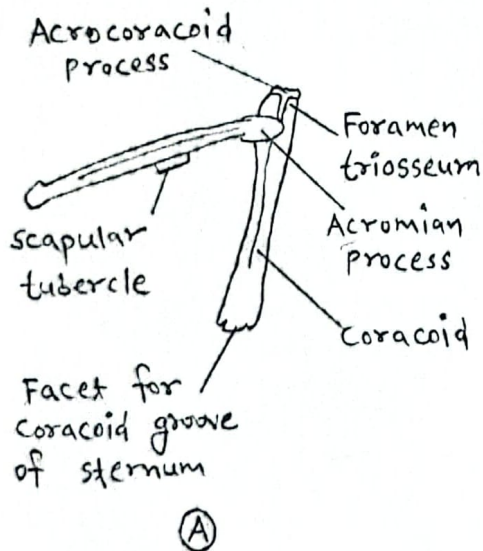
16/10/23





Pectoral girdle & Sternum of Frog

Varanus: (A) Pectoral girdle (B) Episternum



Fowl: (A) Pectoral girdle (Right half) (B) Furcula

Pectoral girdle of Rabbit (Right half)

## Pectoral girdle

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Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

### \* Pectoral girdle & sternum of Frog:-

1. Pectoral girdle

is present in the thoracic region and provides attachment to the fore-limbs and their muscles.

2. It consists of two similar halves united mid-ventrally and separated dorsally.

3. Each half is divided into dorsal scapular portion and ventral coracoid portion.

4. Scapular portion comprises supra-scapula and scapula.

5. The coracoid portion comprises the clavicle, coracoids, precoracoid and epicoracoid.

6. The sternum lies in the mid-ventral line, it consists of episternum, omosternum and xiphisternum.

### \* Pectoral girdle & Clavicle of Varanus:-

1. Pectoral girdle

of varanus is also made up of two identical halves, firmly attached with a T-shaped interclavicle.

2. Each half is composed of supra-scapula, scapula, coracoid, interclavicle and clavicle.

3. Clavicle is short, curved dermal bone, articulating with supra-scapula and interclavicle.

### \* Pectoral girdle & Furcula of Fowl:-

1. It provides support

to the wings which are modified fore-limbs.

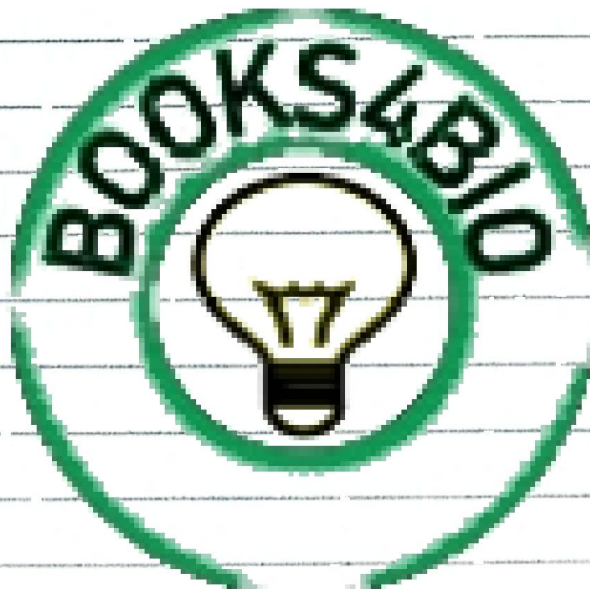
2. Each half is formed of a coracoids and a scapula bone.

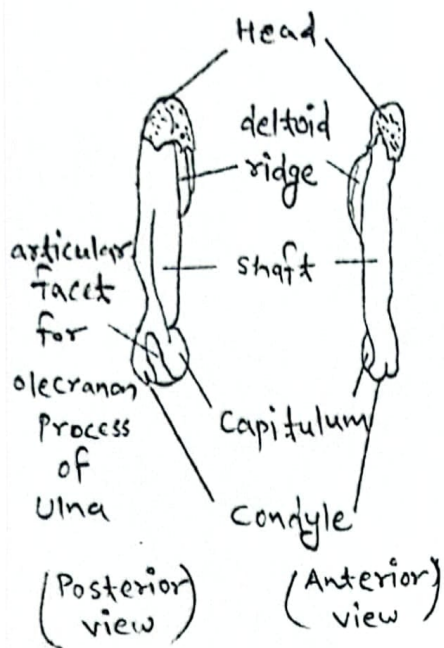


3. At the joint of scapula and coracoid is present a glenoid cavity.
4. The coracoid is stout, straight rod-like ~~the~~ and broader at two ends.
5. Furcula is roughly a 'Y'-shaped or fork-shaped bone of fowl formed of two clavicles and interclavicles.
6. Furcula is commonly known as merry thought or wish bone.

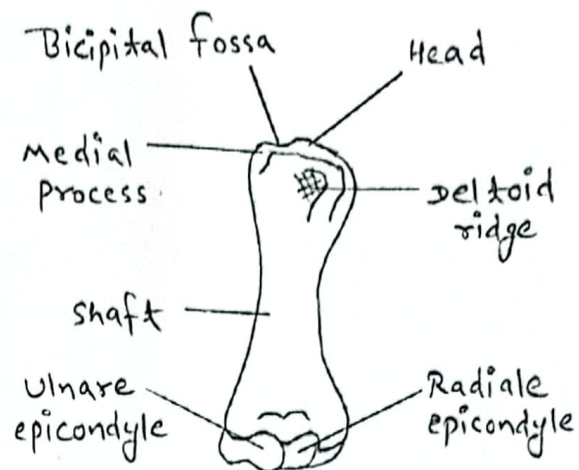
#### \* Pectoral girdle of Rabbit:-

1. Each half of pectoral girdle is made up of clavicle and scapula-coracoid.
2. clavicle is slender rod-shaped, curved and membrane bone. It articulates with manubrium of sternum and acromion process of scapula.
3. scapula-coracoid is a triangular bone. The apex contains a concavity called glenoid cavity for humerus head.

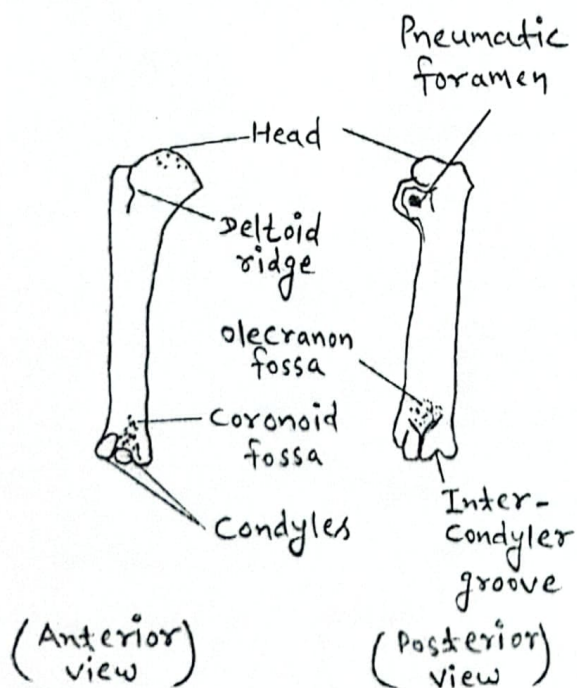




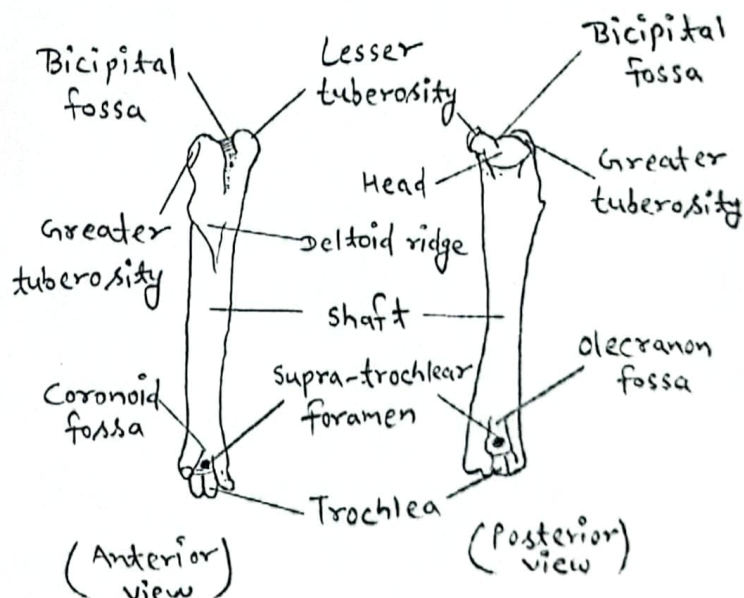
Humerus of Frog.



Humerus of Varanus



Humerus of Fowl



Humerus of Rabbit



## Humerus

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Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

### \* Humerus of Frog:-

1. It is the bone of fore-limb and is the component of upper arm.
2. It is a short, stout and cylindrical bone with a slightly curved shaft.
3. The head is covered with calcified cartilage.
4. The ridge below the head is known as deltoid ridge.

### \* Humerus of Varanus:-

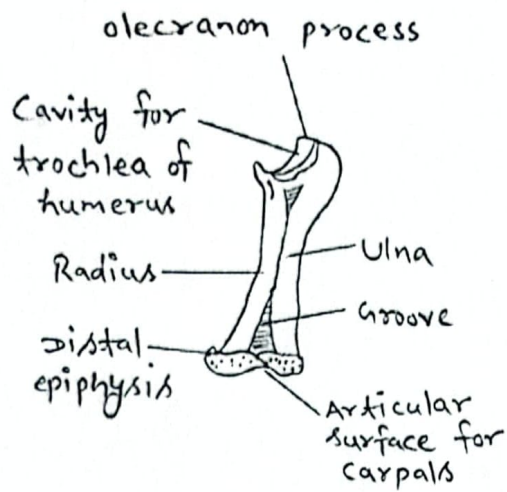
1. It is upper arm, single bone, with both ends expanded.
2. Proximal end contains head which fits into glenoid cavity.
3. The head and a medial process enclose a bicipital fossa.
4. Deltoid ridge present.

### \* Humerus of Fowl:-

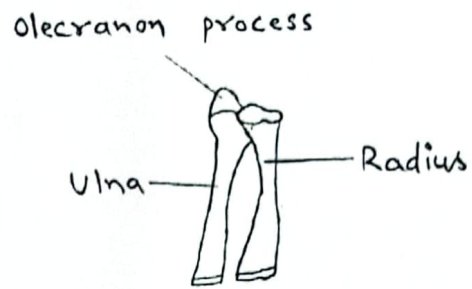
1. The bone is light in weight due to pneumaticity.
2. Two tuberosities are present on either side of head.
3. Near the deltoid ridge is present a pneumatic foramen.
4. The distal end bears a pulley-like trochlea.

### \* Humerus of Rabbit:-

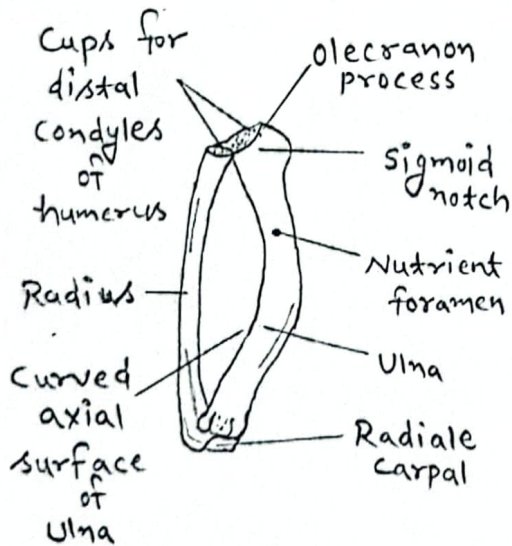
1. It is a rod shaped bone.
2. Head articulate with glenoid cavity.
3. Deltoid ridge present.
4. Just above trochlea are coracoid and olecranon fossae.



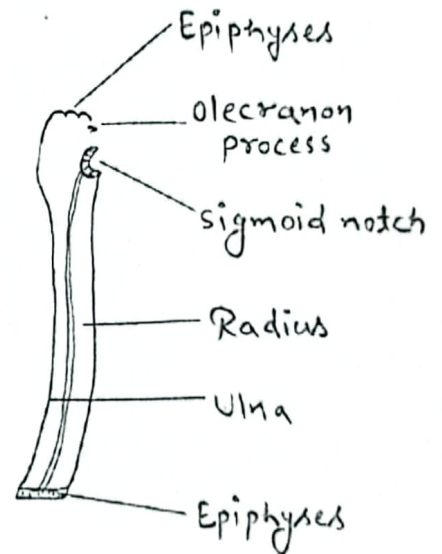
Radius-Ulna of Frog



Radius-Ulna of Varanus



Radius-Ulna of Fowl



Radius-Ulna of Rabbit



## Radius - Ulna

Page: \_\_\_\_\_

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

### \* Radius-Ulna of Frog:-

1. It is a compound bone of fore-limb and is the component of the fore-arm.
2. It is formed by the fusion of radius and ulna bones.
3. The ulna projects into an olecranon process.
4. Distal portion has an articular surface for the metacarpals.

### \* Radius-Ulna of Varanus:-

1. Unlike frog, radius and ulna are not fused.
2. Radius is slender and made up of a shaft and two epiphyses.
3. Ulna is stouter.
4. Proximal end contains olecranon process.

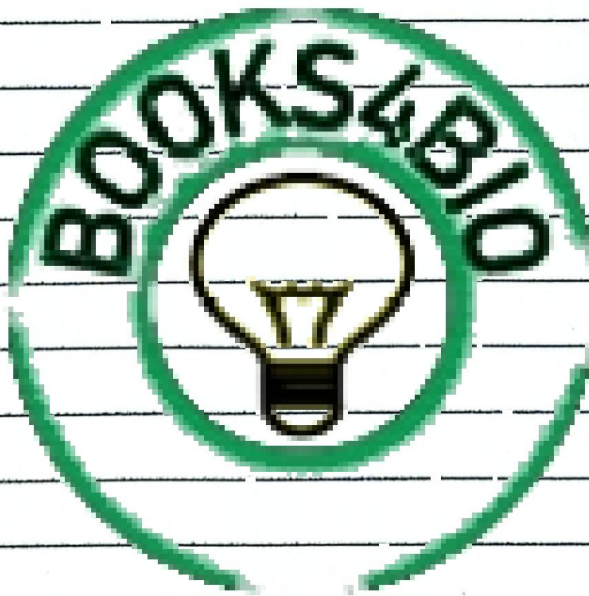
### \* Radius-Ulna of Fowl:-

1. The two separate bones are attached to each other only at their ends.
2. The radius is slender, straight and slightly smaller bones.
3. The ulna is stout, curved comparatively longer bones.
4. The distal end is attached to proximal carpals.

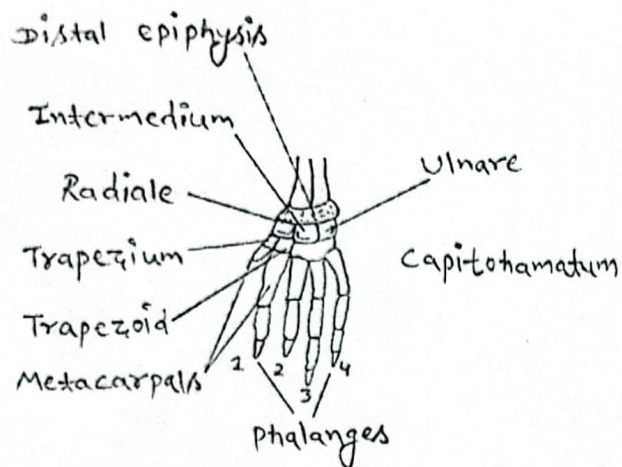
### \* Radius-Ulna of Rabbit:-

1. Radius and ulna are separate but united firmly at both ends.
2. Radius is smaller and curved.
3. At the proximal end of ulna is an olecranon process.
4. At the base of olecranon process is a sigmoid notch.

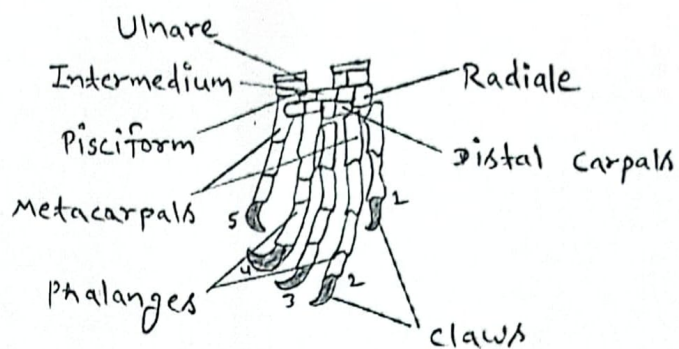
which fits into trochlea of humerus.



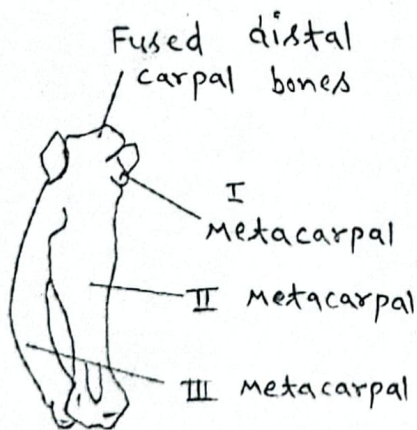




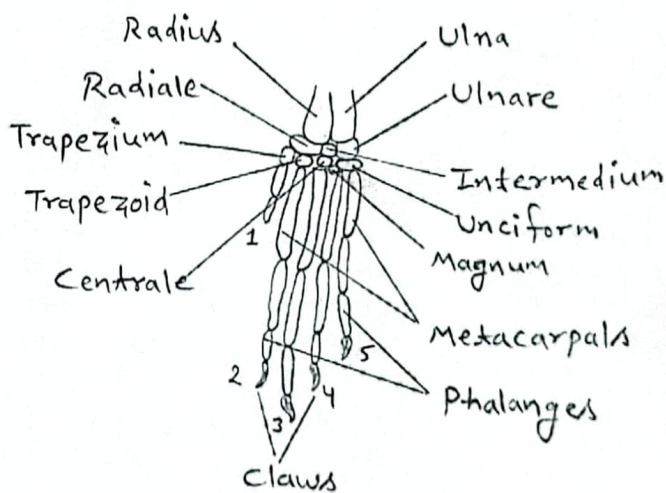
Bones of forehand of Frog



Bones of forehand of Varanus



Carpometacarpus of Fowl



Bones of forehand of Rabbit

## Bones of fore-limb

Page: \_\_\_\_\_

Date: \_\_\_\_\_

### \* Bones of forehand of Frog:-

1. The carpal bones are six in number and arranged in ~~number~~ two rows of three each.
2. The bones of the proximal rows are called ulnare, intermedium and radiale.
3. The bones of distal row are called capitulum, Trapezoid and trapezium.
4. The digit corresponding to thumb is absent.

### \* Bones of forefoot of Varanus:-

1. Wrist is made up of 10 small polyhedral rounded bony carpals arranged in two rows.
2. Proximal row contains 3 Carpals - radiale, ulnare & intermedium.
3. Distal row has 5 carpals.
4. Each terminal phalange contains a horny claw.

### \* Carpometacarpus of Fowl:-

1. It is the compound bone of Palm region of forelimbs (wing) of fowl.
2. The three carpals form the proximal head.
3. The second metacarpal is provided with spine.
4. It provides attachment to remiges feathers.

### \* Bones of forefoot or hand:-

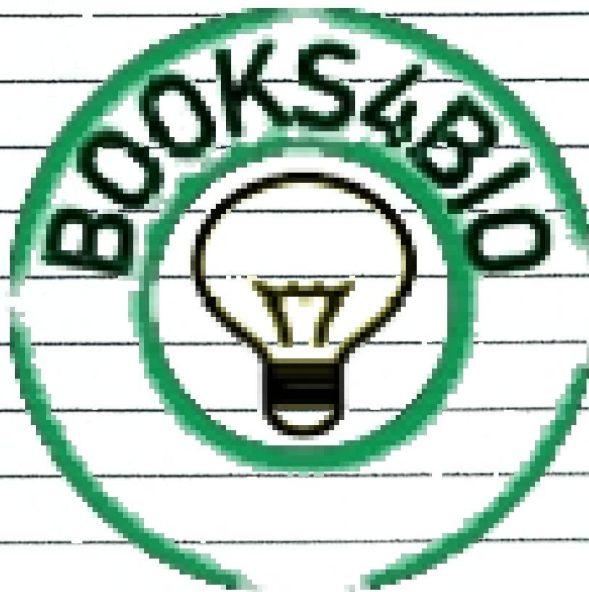
1. Wrist contains 9 small bones in two rows, namely radiale, intermedium and ulnare in

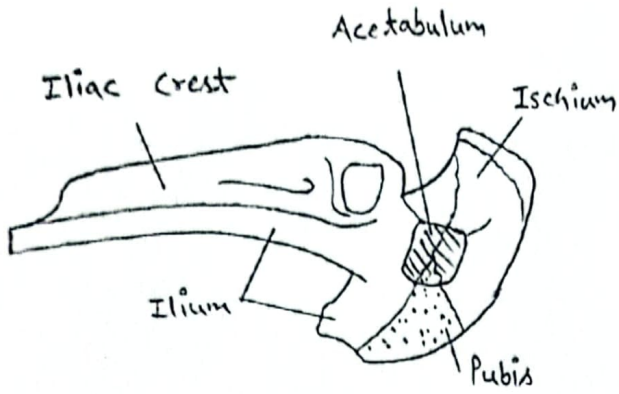


proximal row and single centrale, trapezium, trapezoid, magnum, and unciform in distal row.

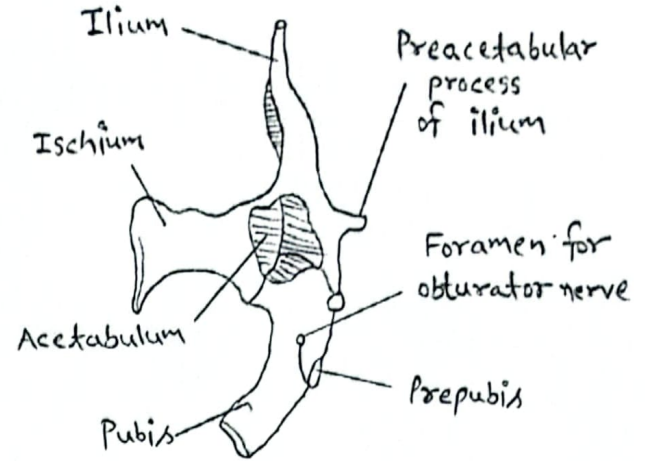
2. A sesamoid bone or pisiform is found on ventral side of Carpus.

3. Terminal phalanx bears a horny claw.

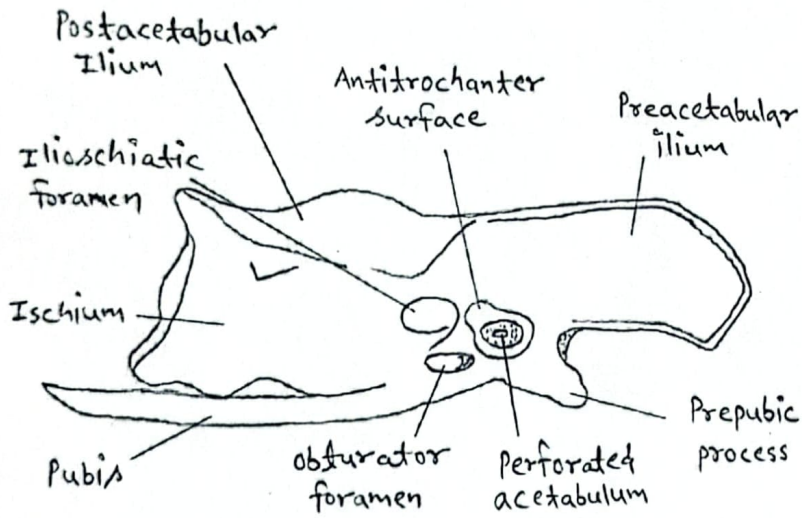




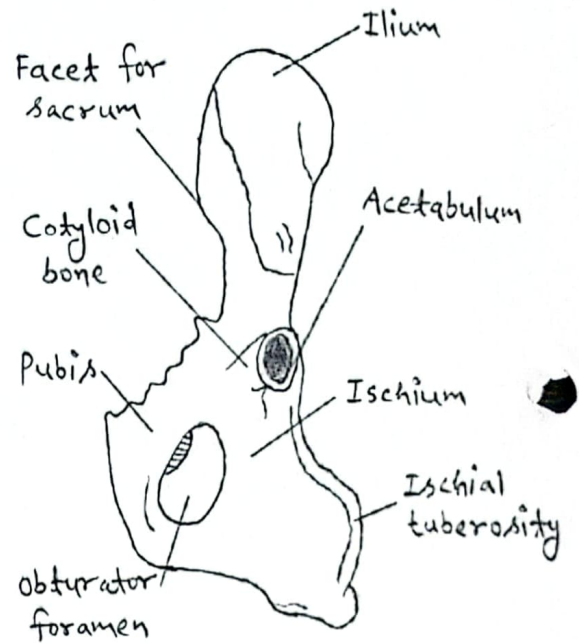
Pelvic girdle of Frog (Left half)



Pelvic girdle of varanus (Left innominate)



Pelvic girdle of Fowl (Right innominate)



Pelvic girdle of Rabbit (Left half)



## Pelvic girdle

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Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

### \* Pelvic girdle of Frog:-

1. Pelvic girdle lies in the posterior region of the trunk.
2. It gives support to the hind-limbs.
3. It is V-shaped and composed of two similar halves each of which is known as os-innominatum.
4. Each os-innominatum is composed of three bones- ilium, pubis and ischium.

### \* Pelvic girdle of Varanus:-

1. It is composed of 3 bones, namely ilium, pubis and ischium.
2. Three bones are very hard and solid.
3. Extremely, at the junction of three bones is a large acetabulum for head of femur.
4. Joints are distinct.

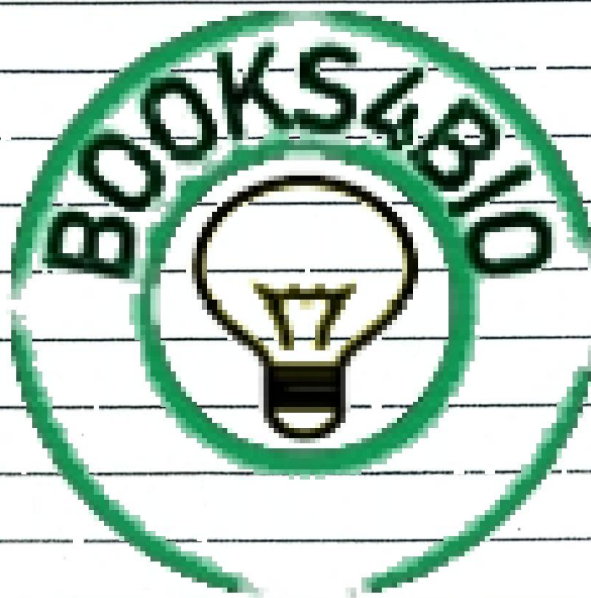
### \* Pelvic girdle of Fowl:-

1. Each os-innominata is made up of ilium, ischium and pubis.
2. At the junction of the three bones is present a cup-like acetabulum.
3. The inner border of ilium fuses with synsacrum.
4. The two ossinnominata do not form symphysis.

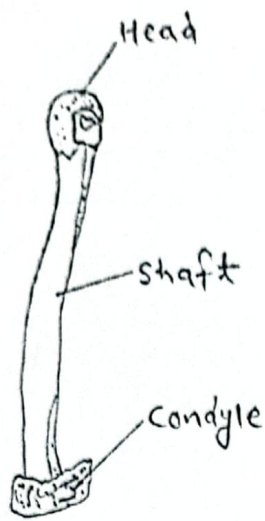
### \* Pelvic girdle of Rabbit:-

1. Two halves of pelvic girdles are united at a pubic symphysis.

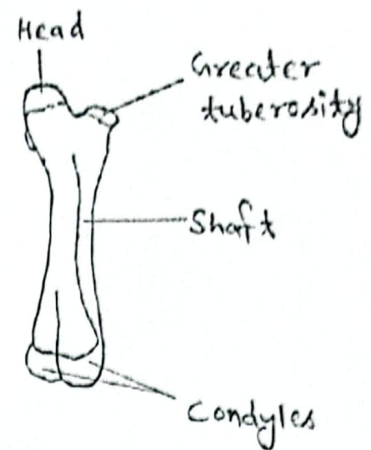
2. Each half or innominate contains ilium, ischium and pubis.
3. Three bones are fused together forming hip bone.
4. External to hip bone is a cup-shaped acetabulum.



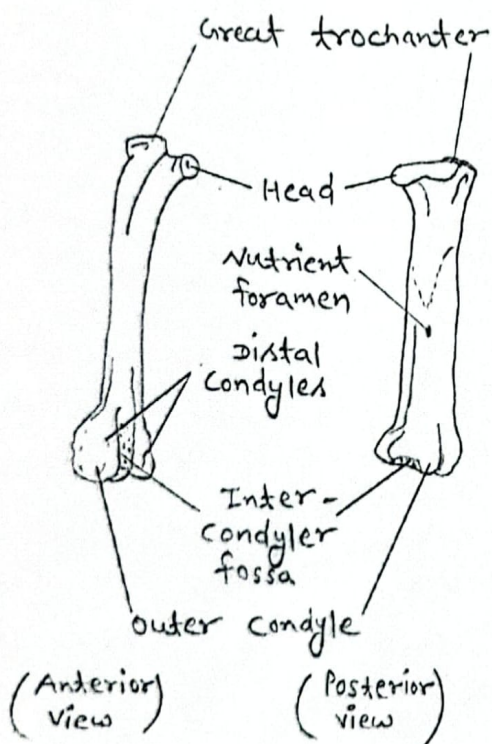




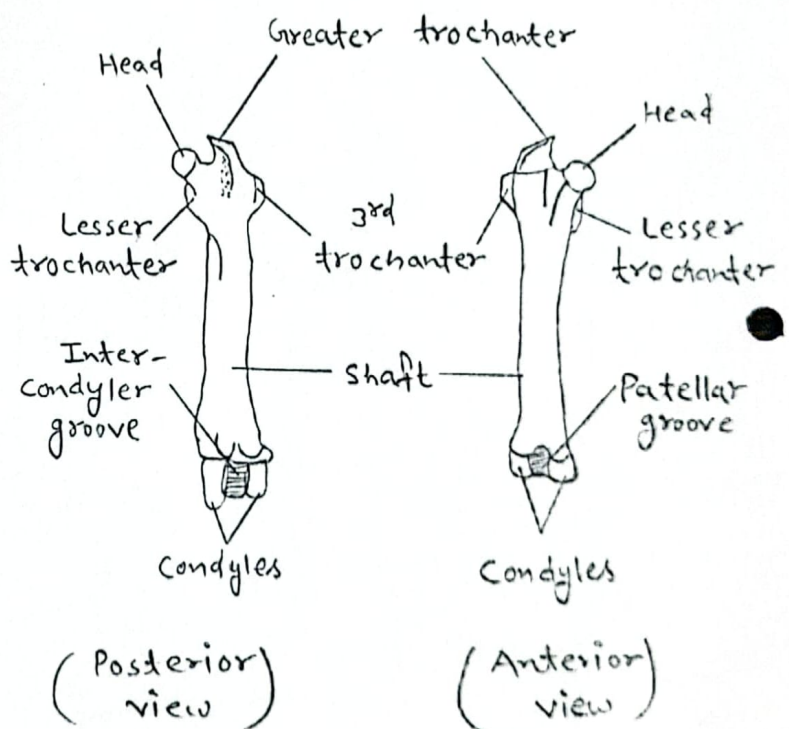
Femur of Frog



Femur of Varanus



Femur of Fowl



Femur of Rabbit

## Femur

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### \* Femur of frog:-

1. Femur is the bone of thigh region of hind-limb.
2. It is long and slender having a slightly curved shaft.
3. The proximal swollen end is called the head.
4. Head fits into the acetabulum of pelvic girdle.

### \* Femur of varanus:-

1. It is thigh bone having 2 epiphyses.
2. Proximal end contains head, which fits into acetabulum.
3. Femur has lesser trochanter and greater trochanter on preaxial and postaxial sides, respectively.

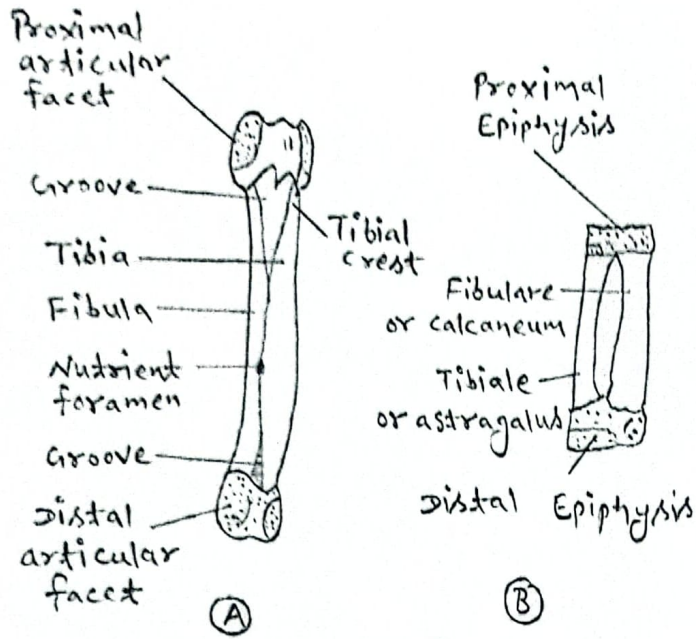
### \* Femur of Powl:-

1. The bone is slightly curved with flat ends.
2. The proximal ends of the bones bears a well defined, round and ball like head on inner side and a great trochanter on the outer side.
3. The head glides in the acetabulum.

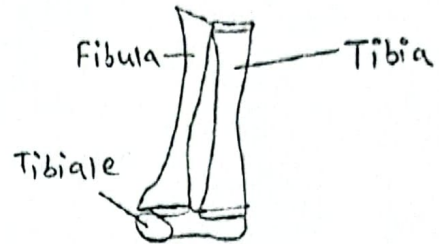
### \* Femur of Rabbit:-

1. Proximal head articulates with acetabulum.
2. Lesser, greater and third trochanters present for muscle attachment.
3. Distally it has pulley-shaped structure.

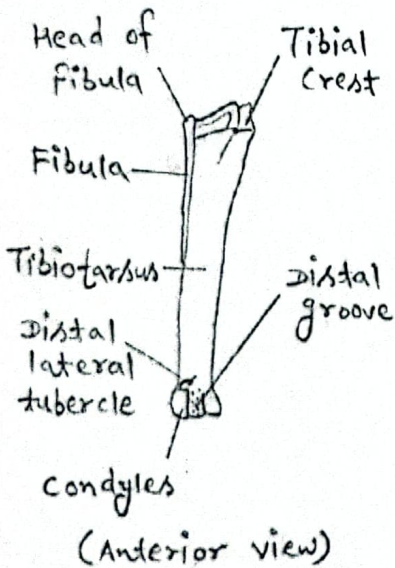




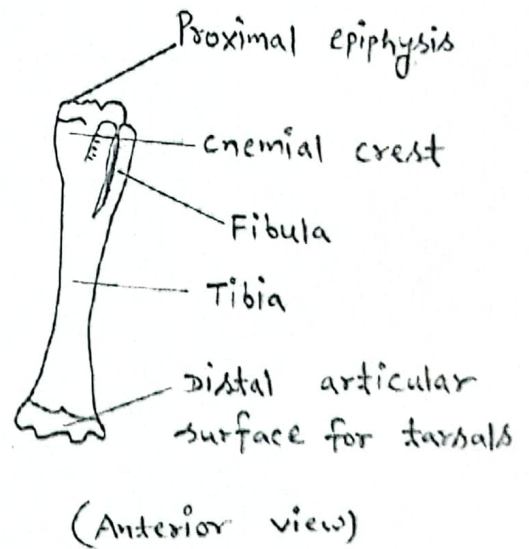
Frog: (A) Tibio-Fibula, (B) Astragalus-Calcaneum



Tibia-Fibula of Varanus



Tibio-tarsus-Fibula of Fowl



Tibia-Fibula of Rabbit

## Tibia - Fibula

Page: \_\_\_\_\_

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

### \* Tibia-fibula of Frog:-

1. Tibia-fibula is a compound bone of the shank region of hind limb.
2. It is formed by the fusion of tibia and fibula bones forming a single bone called the tibio-fibula.
3. The proximal and distal ends are covered by cartilage.

### \* Astragalus-calcaneum of Frog:-

1. It is a compound bone of ankle of hind-limb.
2. The inner bone is thicker and straight curved called the astragalus or tibiale.
3. The outer bone is thicker and straight called calcaneum or fibulare.

### \* Tibia-fibula of Varanus:-

1. These are shank bones.
2. Tibia is stout, curved and on pre-axial side, while fibula is slender and on post-axial side.

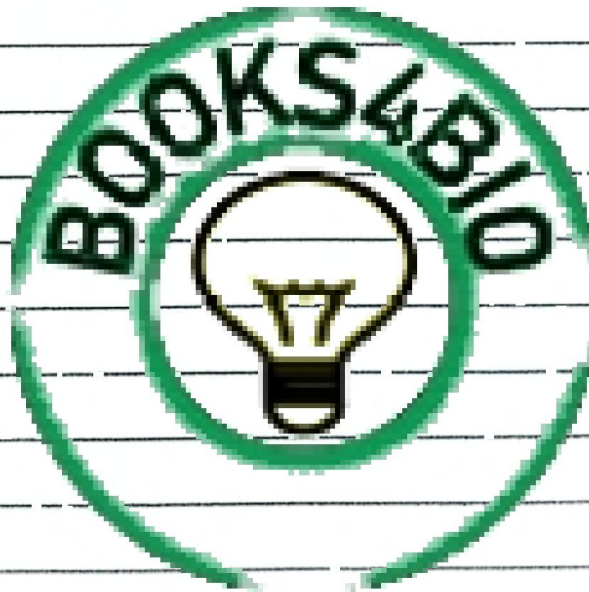
### \* Tibio-tarsus Fibula of Fowl:-

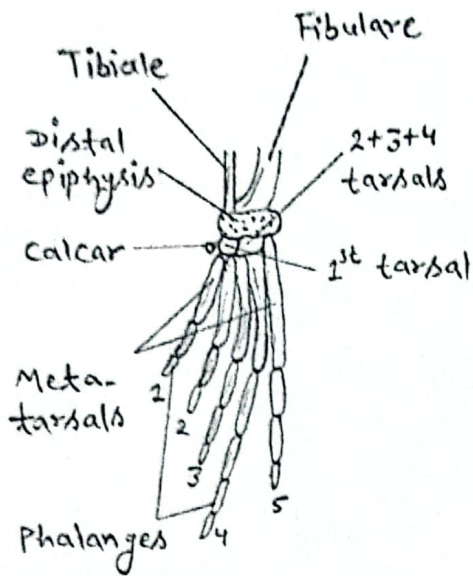
1. It is the compound bone of shank region of hind limb of fowl.
2. Tibio-tarsus is made by tibia and proximal row of tarsals fused with it.
3. Distally, it bears a pulley like structure for articulation with tarso-metatarsus.



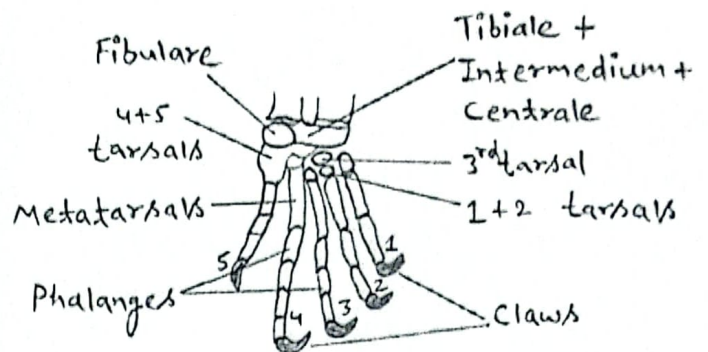
\* Tibio-fibula of Rabbit:-

1. Tibio-fibula form Shank bone.
2. They're free proximally and united distally.
3. Tibia is large and fibula small and distally tapering.

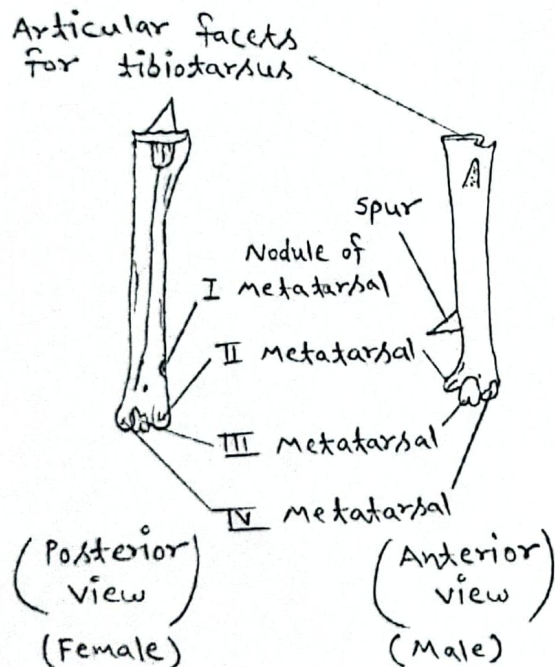




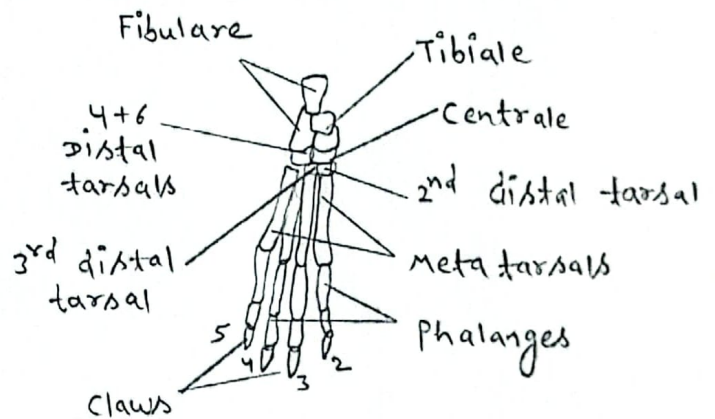
Hindlimb bones of Frog



Hindlimb bones of Varanus



Tarsometatarsus of Fowl



Hindlimb bones of Rabbit



## Hindlimb bones

Page: \_\_\_\_\_

Date: \_\_\_\_\_

### \* Hindlimb bones of Frog:-

1. The foot of frog is supported by five metatarsals bearing five true toes.
2. The metatarsals are long and slender.
3. The 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> metatarsals bear 3 phalanges each.
4. Preaxial 6<sup>th</sup> toe is called the prehallux.

### \* Bones of hindfoot of Varanus:-

1. It is made up of 5 tarsal bones.
2. 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> & 5<sup>th</sup> toes contain 2, 3, 4, 5 & 3 phalanges respectively.
3. Each toe bears a terminal horny claw.

### \* Tarso-metatarsus of Fowl:-

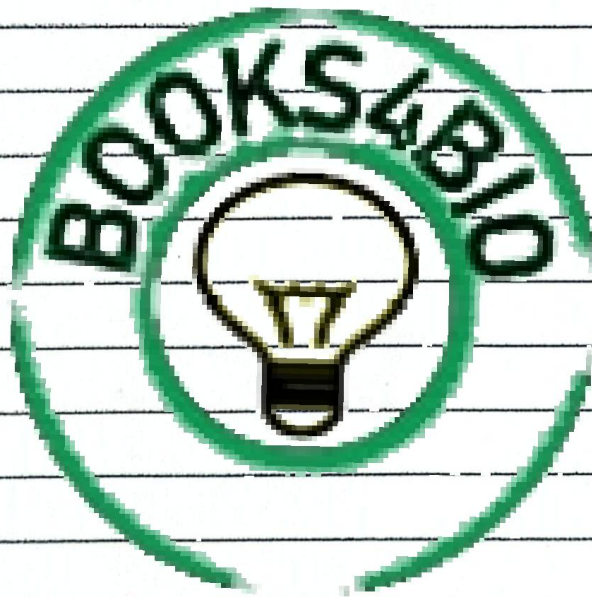
1. It is the compound bone of the ankle region of hind limb.
2. It is formed by the fusion of the proximal row of tarsals with 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> metatarsals.
3. Proximally it bears two facets and one ridge for condyles of tibio tarsus.
4. The spur is absent in female, while present in male.

### \* Bones of hindfoot of Rabbit:-

1. It contains tarsal bones in two rows.
2. Tibiale and intermedium of the proximal row are fused to form astragalus on pre-axial side, while Calcaneum

is the largest tarsal bone produced into a spur on post-axial side.

3. distal row contains three bones- mesocuneiform, ectocuneiform and cuboid.
4. only four toes each having three phalanges, the terminal one bearing a claw.



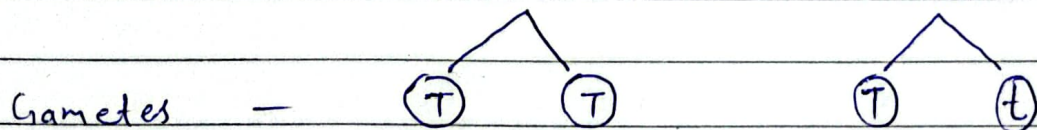


## # Monohybrid cross:-

Question:- In Pea, Tallness is dominant over dwarfness, cross between homozygous tall plant with heterozygous plant and obtain  $F_1$  generation. Write genotype and phenotype ratio.

Answer:- Given, For Tall dominant = T [symbol for gene/allele]  
Dwarf Recessive = t

Parent generation :- Homozygous Tall  $\times$  Heterozygous



Checker board/  
Punnet Square

$F_1 \rightarrow$

♀ \ ♂	T	T
T	TT (tall)	TT (tall)
t	Tt (tall)	Tt (tall)

Result:- Phenotype :- Tall : Dwarf  
4 : 0

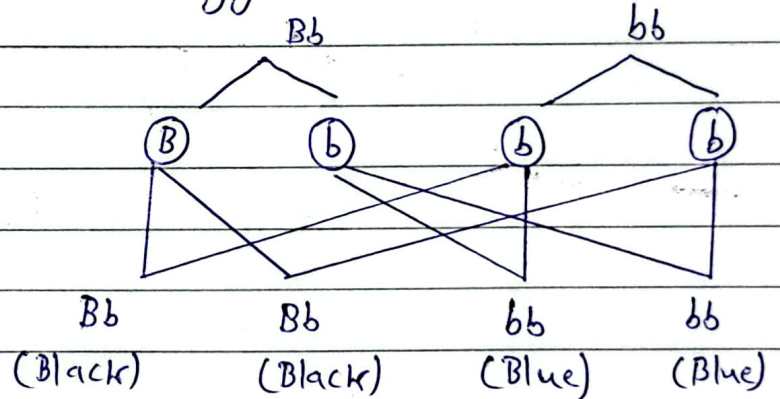
Genotype :- TT : Tt  
2 : 2  
 $\Rightarrow$  1 : 1

Question:- In human eye, Black coloured eye is dominant over blue. One heterozygous Black and another is Blue, find Genotype and phenotype ratios.

Answer:- Given, For, Black dominant = B [Symbol for gene/allele]  
Blue Recessive = b

Parent generation :- Heterozygous Black x Blue

Fork-stick method -



Result:-

Phenotype  $\rightarrow$  Black = 2  
Blue = 2

Ratio  $\rightarrow 1:1$

Genotype  $\rightarrow$   $Bb = 2$   
 $bb = 2$

Ratio  $\rightarrow 1:1$



## # Dihybrid Cross:-

**Question:-** In Pea, Red colour in flower is dominant over white and Tallness is dominant over dwarfness. If colour is heterozygous and dwarf plant is crossed with heterozygous Red and Tall pea plant, then find Genotype and phenotype ratios of offspring.

**Answer:-** Given, For

Colour  $\rightarrow$  Red dominant = R

$\rightarrow$  white recessive = r

Length  $\rightarrow$  Tall dominant = T

$\rightarrow$  dwarf recessive = t

[Symbol of genes/alleles]

Parent generation -  $RrTt \times RrTt$

Gametes :-  $Rt \quad Rt \quad rt \quad rt \quad RT \quad Rt \quad rT \quad rt$

$\begin{matrix} \text{♀} \backslash \text{♂} \\ \text{RT} \end{matrix}$	$Rt$ Red, tall	$Rt$ Red, tall	$rt$ a	$rt$
$RT$	$RRTt$ Red, tall	$RRTt$ Red, tall	$RrTt$ Red, tall	$RrTt$ Red, tall
$Rt$	$RRtt$ Red, dwarf	$RRtt$ Red, dwarf	$Rrtt$ Red, dwarf	$Rrtt$ Red, dwarf
$rT$	$RrTt$ Red, Tall	$RrTt$ Red, Tall	$rrTt$ white, Tall	$rrTt$ white, tall
$rt$	$Rrtt$ Red, dwarf	$Rrtt$ Red, dwarf	$rrtt$ white, dwarf	$rrtt$ white, dwarf

Result:-

Phenotype :- Red tall : Red dwarf : white tall : white dwarf  
 Ratio  $\rightarrow$  3 : 3 : 1 : 1

Genotype :-

Pure Red	impure red	impure red	Pure white	Pure white	Pure red
impure tall	impure dwarf	pure dwarf	impure tall	Pure dwarf	Pure dwarf
(RRtt)	(RrTt)	(RrTt)	(rrTt)	(rrtt)	(RRtt)
1	2	1	2	1	1



# Thomas Hunt Morgan (1928):-

Experimented on Drosophila

melanogaster.

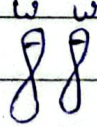


- Characters:- (i) Eye colour  $\rightarrow$  Dominant - Red recessive - white
- (ii) Body colour  $\rightarrow$  Dominant - Black recessive - yellow
- (iii) wing shape  $\rightarrow$  Dominant - Full recessive - Miniature

- $\rightarrow$  All these genes are located on 'X' chromosomes.
- $\rightarrow$  Their allele is not present on 'Y' chromosomes.
- $\rightarrow$  These characters are sex-linked.
- $\rightarrow$  In  $\text{♀}$ , characters gene is present on XX, so they are homozygous or heterozygous.
- $\rightarrow$  In  $\text{♂}$ , characters gene is present on only X, so it is hemizygous.  
i.e.,



In Drosophila, Red eye colour is dominant over white eye colour,

$\rightarrow$  Given, For red eye colour =  $w^+$  [Symbol for]  
white eye colour =  $w$  [gene/allele]

For female ( $\text{♀}$ )

$w w$	$w w^+$	$w^+ w^+$
		
$x x$	$x x$	$x x$
(white homo)	(Red hetero)	(Red homo)

For male ( $\text{♂}$ )

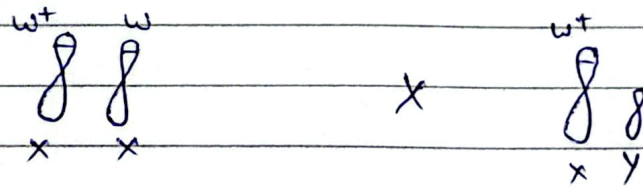
$w$	$w^+$
	
$x y$	$x y$
(white eye)	(Red eye)

Hemizygous

**Question:-** Cross between Red eyed Heterozygous female with red eyed male drosophila, obtain  $F_1$  gen and write phenotype and genotype ratio.

**Answer:-** Given, For, Red coloured eye =  $w^+$  [symbol for]  
white coloured eye =  $w$  [gene/allele]

**Parent:-** Red eyed heterozygous ♀ × Red eyed ♂



♀ \ ♂	$w^+ y$	$y$
$w^+ w$	$w^+ w^+ x$ $w^+ w$	$w^+ y x$ $w^+ w$
$w w$	$w^+ w x$ $w w$	$w y x$ $w w$

**Result:-** Phenotype:- Female  $\left\{ \begin{array}{l} \text{Red eye homozygous} = 1 \\ \text{Red eyed heterozygous} = 1 \end{array} \right.$

Male  $\left\{ \begin{array}{l} \text{Red eyed} = 1 \\ \text{white eyed} = 1 \end{array} \right.$

Ratio = 2:1:1:1

**Genotype:-** Female  $\rightarrow w^+ w^+ \text{ \& } w^+ w$

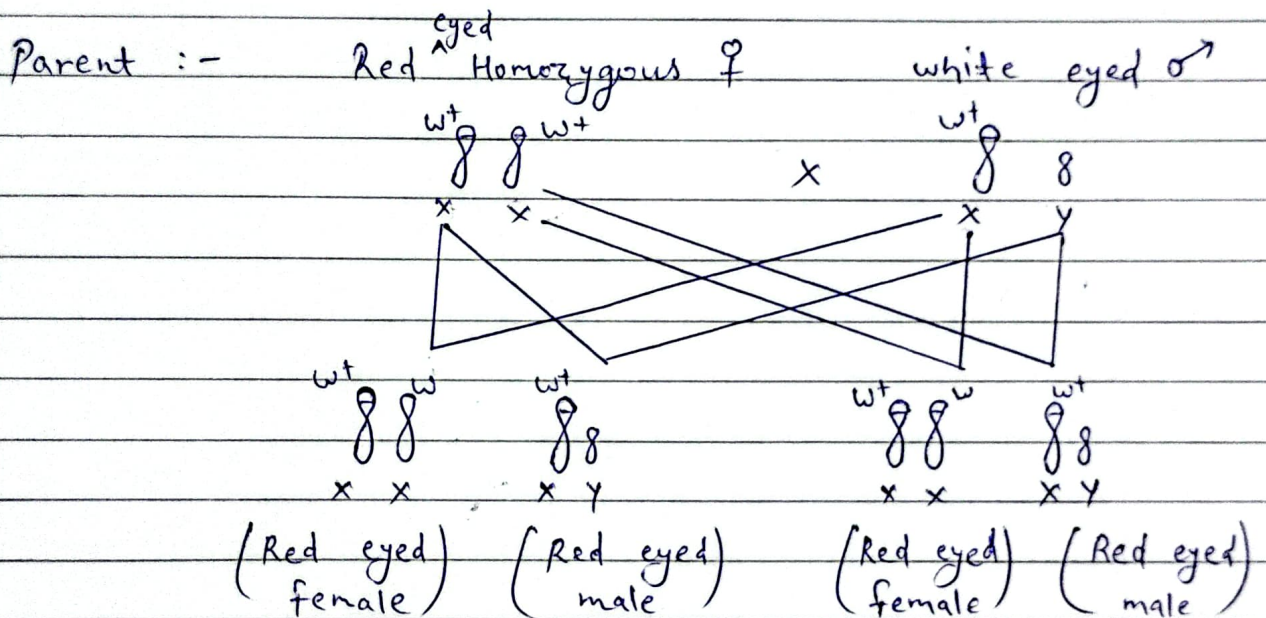
Male  $\rightarrow w^+ y \text{ \& } w y$

Ratio  $\rightarrow 1:1:1:1$



Question:- Cross between Red eyed homozygous ♀ drosophila with white eyed ♂ drosophila, obtain F<sub>1</sub> gen. and write phenotype and genotype ratio.

Answer:- Given, For, Red eye colour =  $w^+$  [Symbol for gene/]  
white eye colour =  $w$  allele



Result:-

\* Phenotype :- Red eyed female = 2

Red eyed male = 2

Ratio → 1:1

\* Genotype =  $w^+ w$  (female) = 2

$w^+ y$  (male) = 2

Ratio → 1:1

## # Food preference in Tribolium:-

- Introduction:- Tribolium is commonly found in all the stored grains and pulses. An experiment can be set to know their food preference.
- Material:-
  1. Container with 100 Tribolium
  2. One medium sized plastic ilayachi-super box
  3. A brush.
  4. Thick paper (Card board)
  5. Thin cloth (Cover the box)
  6. Rubber band
  7. Flours (Aata, besan, suji, maida)
- Procedure:-
  1. Different flours are filled up to brim in different chambers of box.
  2. Tribolium are placed in the centre.
  3. Containers is covered with thin cloth tied around by rubber band and kept in a dark place at  $35^{\circ}\text{C}$  -  $37^{\circ}\text{C}$  temperature.
  4. After a week, take the box out remove cloth, take out the food one by one and count the number of Tribolium in each food type with the help of brush.
  5. Count the dead Tribolium also.



## • Observation:-

Day	No. of Tribolium					
	Besan	Maida	Suji	Aata	Mortality	Total
3 <sup>rd</sup> day	19	24	38	12	07	100
4 <sup>th</sup> day	13	20	42	15	10	100

• Result:- This experiment indicates that Tribolium preferred 'Suji' over other food type.

## # Pheromones in Earthworm: -

- Introduction:- Visual and auditory stimuli can't carry message for earthworm because they do not have visual or auditory organs, mechanical stimuli can be used for communication because this would be limited time. Finally earthworm rely most on chemical communication.
- Material:- Blunt forceps, paper towels, scissors, waxed paper, two sized D batteries connected in series with a wire, strong solution of table salt and water, live earthworm.
- Method:-
  1. At first cut strips of paper towels 2 cm wide, soak them in salt solution and arrange them in a square on a piece of waxed paper.
  2. Put 2 earthworms in the centre of square and then observe their response of each other to the waxed paper and to salt solution.
  3. Put another earthworm on the waxed paper or a tile, give mild shock to earthworm by touching it briefly with wires coming out from the two size D batteries. The shock will cause the earthworm to extrude yellowish coelomic fluid from grooves between segments.



4. Remove this and put another worm and observe its reaction towards the yellow fluid which had oozed out of the first worm.
- **Observation:-** If the response is negative, the worm will jerk its head up and move back, away from the yellow exude thus showing that the coelomic fluid given out by worm due to electric shock was a repelling pheromone. If the experiment is done 100 times then 95% of times earthworms will show negative response.
  - **Result:-** The earthworms communicate by pheromones which are the chemicals expelled from an organism, and elicits a response in a conspecific organism.

## Estimation of free $\text{CO}_2$

Page: \_\_\_\_\_

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

\* Object:- To estimate the free  $\text{CO}_2$  in given water sample.

• Principle:- free  $\text{CO}_2$  in the water accumulates due to microbial activity and respiration of organisms. This imparts acidity to the water because of the formation of carbonic acid.

• The optimum level of  $\text{CO}_2$  is 5 ppm.

• Free  $\text{CO}_2$  is determined by titrating the sample using a strong alkali of pH 8.3.

• Reagents:- 1. Sodium Hydroxide ( $\text{NaOH}$  0.05 N)  
2. Phenolphthalein indicator

• Procedure:- 1. 100 ml. of the sample in a conical flask and add a few drops of phenolphthalein indicator.  
2. The colour changes to pink indicates the absence of free  $\text{CO}_2$ .  
3. In case the sample remains colourless, titrate it with 0.05 N  $\text{NaOH}$ .

4. At the end point a pink colour will appear, note down the reading and calculate as given below.

• Reading:-

S.No.	Vol. of Sample	Burette reading		average
		initial	final	
1	100 ml	0.0	1.9	1.9 ml
2	100 ml	1.9	3.1	1.2 ml
3	100 ml	3.1	4.6	1.5 ml



- Calculation:-

$$\text{free CO}_2 \text{ (mg/L)} = \frac{(\text{ml} \times N) \text{ of NaOH} \times 1000 \times 44}{\text{ml of sample}}$$

- Result:- In given water sample the amount of free CO<sub>2</sub> is 33.73 mg/L

# pH of water sample

Page: \_\_\_\_\_

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

- \* **Object:-** To study water sample for measuring pH with litmus paper.
- **Principle:-**
  - pH is Hydrogen ion concentration
  - pH of water primarily decided by the salt present in where water sample is collected.
- **Requirements:-**
  1. Pond water sample
  2. pH paper
  3. Beaker or container
  4. Tongs or gloves
  5. Clean stirring Rod
  6. pH paper chart
- **Procedure:-**
  1. Collect the pond water.
  2. prepare the pH paper.
  3. Dip the pH paper into the water.
  4. Compare the colour change.
  5. Match the colour with the pH scale.
  6. Record the pH value.
  7. Dispose of used pH paper
- **Result:-** pH paper shows green colour, sample is less basic or alkaline water.  
pH value is  $\rightarrow 7-8$







## # Multiple allele:-

If any character has more than 2 alleles then it is called as multiple allelic characters.

→ It is a feature seen in population.

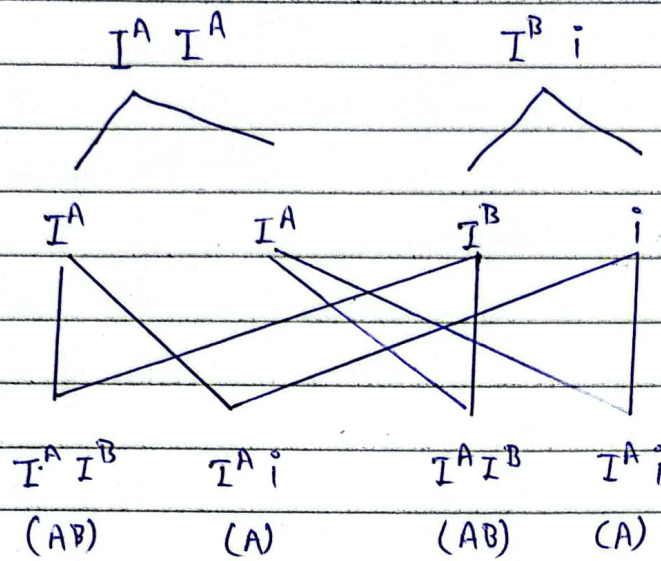
e.g. Blood group ABO system in humans. It is regulated by gene 'I' in human population it has 3 alleles-

$I^A, I^B, i$   
 Dominant                  Recessive

Blood group/ Phenotype	Antigen (Sugar polymer + Protein) on RBC membrane	Antibody in blood plasma	Genotype
A	Antigen A • 	Anti B	$I^A I^A, I^A i$
B	Antigen B 	Anti A	$I^B I^B, I^B i$
AB	Antigen AB 	No antibody (universal acceptor)	$I^A I^B$ (Codominant)
O	No Antigen  (Universal donor)	Anti A & B	$ii$

Question A man is of Homozygous A group & his wife is heterozygous B, what will be the blood groups of their children.

Answer: Given, For Homozygous A =  $I^A I^A$   
 Heterozygous B =  $I^B i$



• Result:- Blood group of children:- AB : A  
1 : 1

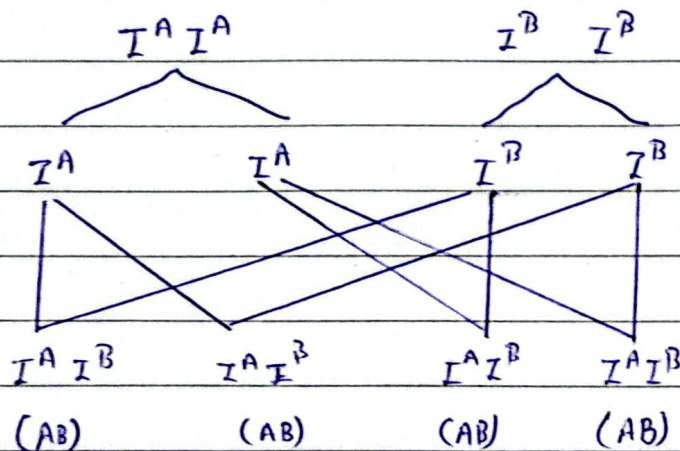


Que. (2)

Man - Homozygous A

Wife - Homozygous B

How many children will be of AB group

Answer:-Given, for Homozygous A =  $I^A I^A$ Homozygous B =  $I^B I^B$ 

• Result:- All children will be of AB group.

Que. (3)

A man doubts his wife, they have 4 children & all have different blood group. explain.

Answer: Given, children have blood group:- A, B, AB, O

Possibility for 'O' group =  $ii$

i.e.

♀ \ ♂ →	$I^A$	$i$
$I^B$	$I^A I^B$ (AB)	$I^B i$ (B)
$i$	$I^A i$ (A)	$ii$ (O)

Result:- if man & his wife have heterozygous A & heterozygous B blood group. then this is possible